

# KA GEOGRAPHY

**Mathematical and Physical.**

DA  
U ONDROMONEY DKHAR,  
*Rtd. Asst. Master, Govt. High School, Shillong.*

**Third Edition**

La pynmih

DA  
I MRS. H. O. DKHAR,

SHILLONG.



SCHOOL SECTION

Reference ... not to be lent out

# KA GEOGRAPHY

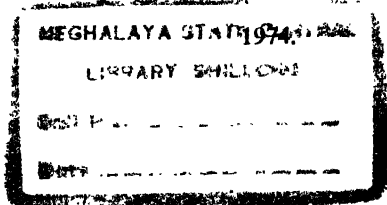
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La shon ha Ri Khasi Press.





## SHIKYNTIEN.

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Kane ka kitab ka long tang kum ki Jingbatai lyngkot (ne ki notes) ban iarap ia ki samla kiba khreh na ka bynta ka Matriculation Examination ba kin sngewthuh shai ha la ka jong ka ktien *shuwa* ia ka Mathematical bad Physical Geography. Ia ki dur ne *diagram* lah ban shem na ka kot Geography ba ki pule ne na kiwei pat ki kot Geography Phareng. La buh ha kane ka kitab tang artylli ki diagram.

Nga ngeit ba ym tang ki samla shong skul hynrei kiwei kiwei ruh lada kin pule ia kane ka kitab ki lah ban ioh ki jingtip ba thymmai shaphang kiei kiei kiba don bad ba jia ha ka Pyrthei jong ngi.

Ka long kaba da eh shisha ban buh ha ka khasi ia ki ktien Geography namar ngim don ktien kum kita. Lada ki nongpule bad kino kino ki lok kin ia sngewbha ban ia-thaw ktien thymmai, ia ki jingpyni jong ki yn pdiang da kaba sngewbha ryngkat bad ka jingiapynshong nia lem.

Shillong  
The 1st November 1932. } U ONDROMONEY DKHAR.

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# KA GEOGRAPHY

## MATHEMATICAL BAD PHYSICAL.



Ka **Geography** ka long ka Jingstad (Science) kaba hikai shaphang ka Pyrthei kum ka jaka shong jong ngi bad ruh ba ngin tip ia kiei kiei kiba jia bad ba don ha ka *sla*. ha *suin* bad *hapoh* jong ka

Lah ban bynta ia ka jingpule ia ka Geography ha ki saw bynta :—

1. **Mathematical Geography** kaba hikai shaphang (a) ka jingiaid ka Pyrthei ha ka haw haw (space) bad ka jingiadei jong ka bad ka Sngi lem bad kiwei kiwei ki Met bneng, (b) ka dur. ka jingheh bad ki jingshad sawdong jong ka bad ruh shaphang ki line ba la shu tharai ba lah ban ring ha ka Globe ne ka Map khnang ban iarap ban sngewthuh kham shai ia kita ki jingshad sawdong.

2. **Physical Geography** kaba hikai shaphang ka jing-iashong ka khyndew bad ka um, ka jingat jingthem ka *slə* ka khyndew, ka *suin* bad ki lyer, ka duriaw bad ki jingtuid tawiar ka um, ka jinglong ki jaka ha ka jingshit jing-khriat, ka jingdon ha ki jaka ba iapher jong ki jingthung, ki mrad bad ki mar ba hapoh khyndew.

3. **Political Geography** kaba hikai shaphang ki ri bad ki hima ba iapher ha ka jinglong ka jingsynshar, bad ki jingtrei ki briew kiba shong ha ki bad ruh shaphang ki lad kiba pyniasoh ia ki bad kiwei pat ki hima.

4. **Commercial Geography** kaba hikai shaphang ka jingthung jingtep bad kiei kiei kiba iaidei ha ka khai pateng hapdeng ki jaid bynriew ka pyrthei, nangno bad kumno la ioh ia ki bad ruh shaphang ki lynti syngkien na kiba la pynpoi ia ki sha kylleng sawdong ki bynta ka pyrthei.

## MATHEMATICAL GEOGRAPHY.

Ia ki Met bneng bapyllun la khot ki *Stars*. Don bun jaid ki *Stars* — ki *Fixed Stars*, ki *Planets*, ki *Satellites*, ki *Comets* ne kiba don tdong kiba ngi khot *Lurdihduma*, ki *Meteors* ne *Falling Stars*. Ia kine ki *Stars* lah ban iohi da ki telescope heh ba ki don ha ka *Milky way* kaba long ka jaka (tract) kum ka kynhun bah ba lam byrlieh jong ki ha suin

Ki **Fixed Stars** ki neh ha kajuha ka jaka, ki don jingshai halade bad ki don bun million ruh. Ka **Sun** ne Sngi ka long uwei na ki *Fixed Stars* ki ba rit, ka i kumba ka heh ia kiwei pat ki *Fixed Stars* namar ba ka kham jan ia ngi.

**Planets** (ne ki nongiaid sakma) ki long ki *Stars* kiba iaiaid sawdong ia ki *Fixed Stars*. Kine kim don jingshai halade hynrei ki ioh jingshai bad jingshit na ki *Fixed Stars*.

Don 9 ki *Planets* kiba iaiaid sawdong ia ka **Sun** ha ka jylli ha ka haw haw (space) kaba khot *Orbit*. Ia ki 4 tylli kiba khamjan ia ka — *Mercury*, *Venus*, *The Earth* (ka pyrthei jong ngi) bad *Mars* — la khot *Inner Planets*; 5 tylli pat kiba kham jngai ia ka — *Jupiter*, *Saturn*, **Uranus**, *Neptune* bad *Pluto* — la khot *Outer Planets*. U *Planet* ba phyrnai tam long u *Venus*; haba u paw sha ngi janmiet ynda sep sngi ki khot *Evening Star* bad haba u paw shwa ban shai mynstep *Morning Star*; ha ki miet ba dum bnai u kham tyngshaiñ.

**Satellites** (ne ki nongbud) — Bun na ki *Planet* kiba don kiwei pat ki *planet* rit (*Secondary Planets*) kiba iaiaid ne bud sawdong ia ki bad ia kita la khot *Satellites*. U *Moon* ne u Bnai u long u *Satellites* ka *Earth*.

Ia ka *Sun* bad ki *Planet* lem bad ki *Satellite* jong ki la khot *The Solar System*.

Ka *Sun* ka long ka kynja pheid pheid balieh bad ba khluid (white hot gas). La ka neh shisha ha kawei ka jaka hynrei ka rotate ha la u axis  $27\frac{1}{4}$  sngi shisien rotate, ha

kata ka rukom ka ai jingshai bad jingshit ia ka Earth bad ki Planet.

Ki ngeit ba mynhyndai kulong ka Sun, ka Earth bad ki Planet baroh lem bad ki Satellite ki long kawei ka Met bah bakhraw jong ka pneid pneid ba long ding (blazing gas) kaba shad sawdong ialade ne *rotate* stet eh Katba ka por ka nangiaid kawei kawei na ki lynglun jong kata ka Met bah ka pra bad ka phet sha jngai ha la ka lynti ha ka haw haw ka da rotate ha la u axis. Ha kata ka ka rukom la pynlong ia ki Planet bad ki Satellite, ki da rotate bad shad sawdong ne *revolve* ia kata ka lynglun kaba nyngkong kaba long kum ka kmie—*The parent Sun*.

Ia ka Lynglun pneid pneid bakhfluid (hot mass of gas) kaba iai shad sawdong ialade na kaba la pynlong ia ki Met bneng ki khot *Nebula* Ki nongpeit telescope ki ong ba don bun ki Nebulae kiba dang rotate sawdong ialade mynta bad hadien katto katne snem kin sa mih ki *Star* ne ki *Pyrthei bathymmai* na ki.

Kawei na ki ain ka long ba ka jingshit ka pynheh ia kano kano ka met ba long gas (mass of gas) bad haba kata ka met ka la kynriah sha jngai kaba shapoh jong ka ka shit hi, kaba shabar pat (surface) ka khriat bad don ha ka, kata ha ka surface, ki bynta kiba kylla ban eh kum ka *khyndew* bad kiwei pat ki kylla *um*. La pynlong ia ka Earth jong ngi ha kata ka rukom.

Ki Star, ki Planet bad ki Satellite ki don la ka bor ban ring ia kiei kiei sha lade bad ki iaring ruh para ma ki hi. Lada ngi kynting ia kiei kiei sha suin wat lada i long i shñiuh ne i sner i barit in hap hi ha khyndew, lane lada ngi kawang maw na jrong lum ne na khlieh riat uta u maw un ym hap jngai kumba ngi kawang ha madan: kine ki pyni ba ka Pyrthei ka don ka bor ban ring ia kiei kiei sha lade. Te ka Sun namar ba ka heh, ka bor ring (attraction of gravity) jong ka ruh ka khraw ban ia ka bor ring ki Planet, namarkata ki dei ban shad sawdong ia ka ha ka haw haw syriem kumba u kulai ba la teh ha u dieng ba la thung pynskhem u dei ban mareh sawdong ia uta u dieng namar ba ka bor ring jong u ka kham khraw ia ka jong u kulai. Ia kane ka ain jong ka *Attraction of Gravity*

la shem da u Sir Issac Newton la kumba 200 snem mynshuwa.

Kane ka ain ka don ha kiei kiei baroh; kaei kaei ka baheh ka ring ia kaei kaei ka barit bad kaei kaei ka barit ruh ka ring ia ka baheh, tang ba ka bor jong kaba heh ka kham khlain. Ka Sun ka ring ia ka Earth khamtam ia ka Khyndew (solid Earth), u Moon ruh, la u rit, u ring ia ka Earth khamtam ia ka Um (liquid Ocean), ka Earth ruh ka ring ia ka Sun bad ia u Moon bad namar ba u Moon u jan eh ia ka bor ring jong ka leit kham bun ha u bad kham khyndiat ha ka Sun. Ka Earth ka ring ruh ia ka lyer ba kumta ka lyer ka don barobor ha sla bad haneng khyndew.

Ia ka Kynhun (Group) ki Stars kiba kham phyrnai kiba iadon shi jaka la khot *Constellation* Don kumba 6000 ki Fixed Star kiba lah ban iohi da ki khmat, hynrei da ki telescope ki babha lah ban iohi ba ki don sa 20 million shuh ha la ki jong ki jong ki *Constellation*. Ka Sun ka don hapteng 12 tylli ki *Constellation* kiba ki khot 'the "signs" of the *Zodiac*', (ne ki dur jong ki mrad) namar haba peit ki i kum ki mrad kiba ialang shi jaka. Ia kawei ka *Constellation* kaba lah ban iohi na ka Northern Hemisphere la ai kyrteng *Cancer* (ka Tham) bad ia kawei pat kaba lah ban iohi na ka Southern Hemisphere *Capicorn* (u 'Lang don reng) namar ki ia syriem ha ka dur ia ka Tham bad u 'Lang don reng).

Ia ka *jaka* ne ka *point* ha sun kaba haneng ki Pole la khot *Celestial Pole*.

Ka don kawei ka *Constellation* shajan u North Pole kaba ki khot *Great Bear* kaba syriem ka dur ia ka dngiem heh. Ha ka don 7 tylli ki Stars, artylli na ki kiba ki khot ki *Pointers* (ne nongkdew) ki kdew sha uwei pat u Star baphyrnai uba jngai khyndiat na ki uba ki khot u *Pole Star* ne *North Star* uba hajan u *Celestial North Pole*. U Pole Star u don ha ka *Constellation* kaba kham rit kaba ki khot *Little Bear* kaba syriem ka dur ia ka dngiem khun.

Ka long kaba donkam eh ban tip shano don u Pole Star, khamtam ki nongiaid duriaw, namar haba phai pyrshah ia u kata ngi phai sha North bad kaba shadien ka long ka South.

la ka Constellation Great Bear la khot ruh *The Plough* namar lada yn ring line na u Pole Star sha ka ka i kum ka dur ka lyngkor.

Ki Fixed Star ki neh shijaka hynrei ngi ki briew ngi iohi kumba ki iaid namar ba ha ka jingshisha ka Earth ka rotate ha la u axis.

**Ka Dur bad Jingheh ka Earth.**—Ka Earth ka long kum ka globe. kata kaba pyllun ka da madan khyndiat ha ki artylli ki tdueh sha North bad South kiba ki khot ki Pole; hapdeng ki kham at mdung (bulging), kata ha baroh sawdong ki jaka u Equator uba long u line pyllun ne u panpoh bah uba la tharai ba u kyllain sawdong ia ki jaka pdeng ka Pyrthei.

U Diameter lyngba ki jaka pdeng ka Pyrthei (*Equatorial Diameter*) u long 7926 mile bad u Diameter uba na uwei u Pole sha uwei pat (*Polar Diameter*) u duna ia u  $26\frac{1}{2}$  mile, kata u long  $7899\frac{1}{4}$  mile.

Ka Circumference baroh sawdong u Equator ka long 25000 mile, bad ka Area ka surface ka Earth ka long kumba 197 million square mile.

Ka Sun ka heh  $1\frac{1}{2}$  million shah ia ka Earth bad 500 shah ia ka jingheh ki Planet baroh haba shim lang. Ka Earth pat ka heh 49 shah ia u Moon.

Ka jingjingai na ka Earth sha ka Sun ka long kumba 93 million mile. Ka shim kumba 8 minute ia ka jingshai ka Sun ban poi ha ka Earth namar ka jingshai ka iaid kumba 18600 mile shi second.

Ki sakhi na kiba la ring nia ba ka Pyrthei ka pyllun ki long:—

1. Ki briew kiba shong harud duriaw haba ki peit haba wan ka jhad sha ryngkew ki iohi nyngkong ia ka khlieh jong ka bad hadien hadien sa ia ka met bah baroh kawei kumjuh ruh haba ka mih ban leit sha duriaw jah nyngkong ka met bad hadien eh sa ka khlieh. Lada ka pyrthei ka madan ka jhad kan paw lane kan jah baroh kawei shisyndon naduh khlieh haduh kjat.

2. Haba bam-hynroh u Bnai ym dei shisha ba ka bam ka hynroh, hynrei ba ka Pyrthei ka don beit hapdeng ka

Sngi bad u Bnai haba pyllun (full moon) bad ba ka syrngiew jong ka ka shat beit ha u Bnai. Te ngi iohi barobor ba kato ka dak iong kaba kah ia u Bnai, kaba long ka Syrngiew jong ka Dur ka Pyrthei, kam bam beit hynrei ka bam pyllun.

3. Haba peit na madan ne na duriaw ia ka *horizon*, kaba long ka pud baroh sawdong ha kaba ka i kumba ka suin bad ka khyndew ki ia kynduh lang, iohi ba ka pyllun. Lada nang kiew sha ka jaka ba kham jrong, kum ki jaka lum, ka jingiohi pyllun ka nang heh bad iar. Kane ka jingshisha ka long tang ha kiei kiei kiba pyllun (sphere ne circle). Nalor kata ruh haba peit ia ka Suin kaba long kum ka jingtap ka Pyrthei iohi ba ka pyllun, te ka Pyrthei ruh kaba shah tap ka dei ban long kaba pyllun.

4. Ki briew da kaba iai king ia ka jhad sha kano kano ka phang khlein da kylla dien, hadien hadien ki poi pat sha ki thain na kiba ki la mih. Lada ka Pyrthei ka madan kin shem la kumno kumno ia ki tduh ka jingkut jong ka.

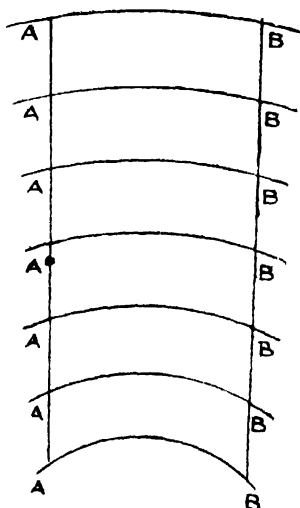
5. Ka Sngi ka paw nyngkong sha ki jaka mihngi bad hadien sha ki jaka sepngi, ka jah pat kham kloï sha ki jaka mihngi bad kham hadien sha ki jaka sepngi, kata katba ka nang shai sha kiwei ki jaka ka nang long miet sha kiwei pat. Lada ka Pyrthei ka madan ngin ioh sngi bad miet ryngkat baroh shi pyrthei ha kajuh ka por.

6. Ka dur ki Met bneng baroh ba ngi iohi ka pyllun, kumta ka shongnia ban ngeit ba ka Pyrthei ruh ka pyllun.

7. Katba nang iaïd shaphang shathie na u North Pole ka jingiohi ia ka jingiengbeit ha jrong ne ka *altitude* u Pole Star ha suin ka nang hiar nang hiar bad na u Equator iohi ia u Pole Star ba u don ha ka horizon; katba nang iaïd pat kham shathie u Equator ym lah ban iohi shuh ia u Pole Star. Don pat ki Constellation kiba iohi na ka Northern Hemisphere hynrei ki bym lah iohi na ka Southern Hemisphere, don ruh kiba lah bah iohi na ka Southern Hemisphere hynrei ki bym iohi na ka Northern Hemisphere. Lada ka Pyrthei ka madan dei ban iohi ia u Pole

Star bad ia ki Constellation baroh na ki jaka ka Pyrthei baroh.

**Balei te ka pyrthei ka i kumba ka madan?** Haba ieng na ki artylli ki jaka ha ka circumference ka circle



kaba rit lah ban iohi ia ka jingkhun pyllun jong ka, haba ka circle ka kham leh pat bad haba ieng katjuh ka jingjingai, ka jingkhun pyllun ka duna i kumba ka madan. Ha kane ka dur ka jaka hapteng A. B. ha ka circle barit eh ha kjat ka khun, hynrei ha ka circle baheh eh kaba ha khlieh ka i kumba ka madan. Te ka Pyrthei ka long ka circle kaba heh kat ha duh ba ngim lah ban pyrkhut ia ka jingheh jong ka bad ka jingkhun jong ka ka long

tang 8 inshi ha man la ka shi mile ne 63360 inshi bad ym lah ban iohi da ki khmat ia kata ka jingkhun kaba rit katta katta. Haba kumta te ka Pyrthei ka i kumba ka madan

**Ka Pyrthei ka don artylli ki jingshad sawdong:--**

1. Ka *shad* ne ka *kyrih sawdong ialade* hi ha la u axis (lane u line ba la shu tharai ba u sam lyngba ia ka na North sha South Pole) syriem kumba *kyrih* ka latom sawdong ialade la kane ka *jingkyrih sawdong* jong ka ialade la khot *Rotation*, bad ka shim por 24 kynta lane shisngi shimiet ba ka Pyrthei kan pyndep ia la ka *Rotation*.

2. Ryngkat bad la ka *jingkyrih sawdong ialade* ka Pyrthei ka *shad ia iaid sawdong ia ka Sngi* ha la ka orbit la kane ka *jingshad iaiaid sawdong ia ka Sngi* la khot *Revolution*, bad ka Pyrthei ka pyndep ia la ka *Revolution* ha ka 365 sngi bad 6 kynta lane shi snem.

**Ki Nia ba la ring ba ka Pyrthei ka rotate ha la u axis ki long:—**

1. Haba ngi peit ha ki Met bneng, kata ka Sngi, u Bnai bad ki Star, ngi i ba ki mih na mihngi bad sep sha sepngi. Kane ka dei ban long ba *ma ki* ki shad sawdong ia ka Pyrthei lah ba ka Pyrthei ka shad ha la u axis Hynrei ka bym lah ban ngeit ba ka Sngi kaba heh bun shah ia ka Pyrthei ba kan shad sawdong ia ka ha ka jingstet baphylla shisien tang 24 kynta ; te namarkata la ngeit ba ka pyrthei ka dei ban shad ha la u axis.

2. Na ka dur ka Pyrthei hi. Ki Met pyllun kiba long pneid pneid bad khfluid (gas) ha ka banyngkong, katba ki nang kyrih sawdong ialade ki nang eh bad haba kumta ki jaka ba ha khlieh bad ha kjat jong ki ki madan bad kaba hapdeng ka at mdung. Ka Pyrthei ruh ka long kumta ha la ka dur namar ba ka shad ha la u axis jngai na ka Sngi.

**Mih aiu na ka Rotation ka Pyrthei?** Ka Pyrthei haba ka rotate ha la u axis ka pynphai ia ki jaka jong ki baroh mar mar kylliang sha pyrshah ka Sngi kumta ba katba kiwei ki jaka ki nang shai kiwei pat ki nang dum ha kata ka rukom ka pynlong ia ka Sngi bad ka Miet man ka 24 kynta.

Ka Pyrthei ka rotate ha la u axis *na West sha East*, namarkata ioh sngi nyngkong ki jaka ba sha East bad hadien sha ki jaka ka West.

**Ba ka Pyrthei ka rotate na West sha East lah ban ring nia na kane:—**Lada pynhap ia u maw shapoh ka pung kaba rit bad kaba jylliew kaba don tang khyndiat ka um ngin iohi ba uta u maw un ym hap beit hapoh um hynrei un patied nyngkong ia ka liang mihngi kata ka pung. Kumjuh lada ieng najrong u mot u babeit bad lada pynhap ia u maw rit na ka liang mihngi u mot yn iohi ba u maw un ym hap beit ha kjat thik hynrei un hap kham pajih khyndiat shaphang mihngi. Kane ka pyni ba ka Pyrthei ka rotate na West sha East.

U Axis um ieng beit at right angles (kata um long perpendicular ne  $90^\circ$ ) ha ka lynti ha ka *plane* ka orbit jong ka hynrei u khun  $66\frac{1}{2}^\circ$ , namar *lada u ieng perpendi-*



*cular* kata yn ioh mar 12 kynta ki sngi bad 12 kynta ki miet man ka sngi ha ki jaka ka Pyrthei baroh, bad ruh ka jingshit bad ka jingkhriat kan long kajuh man ka sngi baroh shisnem; lane lada u long *parallel* ia ka plane ka orbit kan ioh jingshai bad jingshit barabor tang shiteng ka Pyrthei bad shiteng pat kan dum bad kan khriat. Hynrei kam long kumta; namar kata la ngeit ba u Axis u khun ha  $66\frac{1}{2}^{\circ}$ ; bad dei na kata ka daw ba don ka jingiapher ha ka jingjrong bad jinglyngkot ki sngi bad ki miet bad kumjuh ka jingiapher ha ka jinglong ki aiom.

**Ka Bor ne ka Jingstet haba ka Pyrthei ka rotate (speed of Rotation).** Kumba ka latom haba ka shad ka khieh stet ha ki jaka ba hapteng katba ha khlich bad ha kjat (kata ha u nar) ka shu ieng thik, kumjuh ruh ka Bor ka jingstet haba ka Pyrthei ka rotate ka jur eh (lane ka long greatest) ha ki jaka u Equator. Ha kita ki jaka ka long kumba 1000 mile palat shi kynta lane 17 mile man ka minit, katba nang kham shatei bad shathie ka nang duna nang duna ka bor ka jingstet haduh ba ha ki Pole ka long zero. Ki briew kiba ha Calcutta ki iaid sawdong ryngkat bad ka Pyrthei 16 mile man ka minit, kiba ha London pat 11 mile man ka minit.

**Ki Nia ba la ring ba ka Pyrthei ka revolve sawdong ia ka Sngi ki long: —**

1. Don ki Star kiba iohi na ka Pyrthei ha kawei ka por bad ynda katto katne ym iohi shuh ia ki, hynrei ynda ha dien shisnem ki paw biang ha kajuh ka jaka; kumta bun ki Star ki iapaw iajah mar mar kyliang. Ka long kumne namar ba ka Pyrthei ka shad ia iaid sawdong ia ka Sngi bad ka iai kylla ia la ka jaka ne ka *position*.

2. Lada ngi peit man ka sngi sha mihngi sha ki jaka ne ki *point* ha ka horizon na kiba ka mih ka Sngi ngin iohi ba kam ju mih na kajuh ka point man ka step. Ha u March 21 bad September 23 ka mih na ka point kaba na mihngi beit, ha u June 21 ka mih na shaphang shatei bad ha u December 21 na shaphang shathie. Ka daw ka long namar ba ka Pyrthei ka *revolve* sawdong ia ka Sngi; lada

ka Pyrthei ka neh ha kajuha ka jaka ka Sngi kan mih na bad kan sep ha kajuha ka point man ka sngi.

**Mih aiu na ka Revolution jong ka Pyrthei?** Ka Revolution ka Pyrthei sawdong ia ka Sngi bad ka Jingkhun u axis ha ka  $66\frac{1}{2}^{\circ}$  ki pynlong ia ki saw aiom ha ka shisnem kiba iapher ha ka jingjrong bad jinglyngkot ki sngi bad ki miet bad kumjuh ha ka jingshit jingkhriat.

**Ka Bor ne ka Jingstet Ka Revolution** (speed of Revolution) ka long 18 mile man ka second, bad ka por ba ka Pyrthei ka pyndep ia la ka Revolution (time of Revolution) ka long  $365\frac{1}{4}$  sngi lane shisnem.

Ka Lynti ka Pyrthei sawdong ia ka Sngi, kata ka Orbit jong ka, kam long ka jylli ba pyllun hynrei ka kham shalytuin.

**Ha kano ka rukom la pynlong ia ka jingkylla ki aiom?**

Haba ka Pyrthei ka revolve sawdong ia ka Sngi u axis u nang khun ha kata ka rukom ba don ki jaka kiba phai beit sha ka Sngi bad don pat kiba phai pyrshing. Ha ka por *pyrem* u axis u khun ha kata ka rukom ba bun na ki jaka ka Pyrthei ki phai pyrshah ia ka Sngi bad ha u March 21 baroh ki jaka ha ka Northern bad Southern Hemisphere ki long kumta. Ha kata ka tarik ka Sngi ka mih beit na ka jaka ne ka *point* ha ka horizon kaba na mihngi thik, namar kata ha kata ka sngi ki sngi bad ki miet ki ia ryngkat baroh shi pyrthei mar 12 kynta. Ia kata ka *point* ha ka suin bneng ki khot *Equinox* (aequs=equal; nox=night) bad ka long ka *Vernal ne Spring Equinox*.

Nadien kata ka tarik u axis u nang khun ban pynphai ia ki jaka ka Pyrthei kiba ha ka Northern Hemisphere pyrshah ia ka Sngi. Ki sngi ruh ha kita ki jaka ki nangjrong katba ki jaka ha ka Southern Hemisphere pat ki nang phai sharing na ka Sngi, bad ki sngi sha ki ki nang lyngkot. U axis u nang phai ba ka Sngi kan mih man ka step kham na shatei shatei haduh lai bnai bad ha u June 21 ka don hajan ka Constellation Cancer bad ia kita ki jaka baroh sawdong ka pyrthei ki khot *Tropic of Cancer*. Ha kata ka tarik ka long ka sngi kaba jrong tam eh ha ki jaka

ka Northern Hemisphere bad ka long ruh *ka pdeng liur* ha ki. Ha London ha kata ka tarik ka Sngi ka mih ha ka por 3.44 A.M. bad ka sep ha ka 8.18 P.M., kumta ki ioh sngi 16½ kynta bad miet 7½ kynta. Ha ki jaka kham shajan ia u North Pole ki sngi ki nang jrong namar ba ki kjat sngi ki shat palat ia u, te ha ki jaka kiba baroh sawdong ia u don 6 bnai ka sngi suda khlem miet bad ia kata ka aiom ki khot *The Midnight Sun*. bun ki briew ki leit sha Hammerfest, ka shnong kaba ha ka Coast ka Norway, ban leit khnih ia kata ka Sngi kaba mih ha ka por shiteng synia.

Ha kita ki por ba ka *long liur* ha ki jaka ka Northern Hemisphere ka *long tlang* sha ki jaka ka Sourthen Hemisphere namar ki kjat sngi ki shat sharing sha ki; ki sngi shata ruh ki lyngkot bad ha ki jaka u South Pole ka don tang ka jingdum suda 6 bnai bad ka 21st June ruh ka long ka sngi kaba lyngkot tam sha ki. Ka Sngi i kumba ka sangeh shipor ha ki jaka u Tropic of Cancer bad ia kata ka por ki khot *Summer Solstice* (sol sun; sto=stand)

Hadien katei ka tarik u axis u nang khun pat ba ki jaka ka Pyrthei kin phai biang pyrshah ia ka Sngi, dei na kata ka daw ba ia kata ka jaka ne ka point ia khot *Tropic* kaba mut ka Jaka phai (Turning point); bad ka Sngi ruh ka nang mih man ka step na shaphang ki jaka na kiba ka la mih nyngkong, bad hadien lai bnai, kata ha ka 23rd September, ka mih biang na ka point kaba na mihngi thik, te ha kata ka Sngi ki sngi bad ki miet ki ia ryngkat biang baroh shi pyrthei bad ia kata ka point ha suin ki khot *Autumnal Equinox* namar ka long ka por *Synrai*.

Nadien kata ka tarik u axis u nang khun ban pynphai ia ki jaka ka Pyrthei kiba ha ka Southern Hemisphere pyrshah ia ka Sngi. Ki Sngi ruh ha kita ki jaka ki nang jrong katba ki jaka ha ka Northern Hemisphere ki nang phai sharing na ka Sngi bad ki sngi sha ki ki nang lyngkot. U axis u nang phai ba ka Sngi ka nang mih man ka step kham na shathie shathie haduh lai bnai bad ha u December 21 ka don hajan ka Constellation Capricorn bad ia kita ki jaka baroh sawdong ka Pyrthei ki khot *Tropic of Capricorn*. Ha kata ka tarik ka long ka sngi kaba jrong tam eh ha ki jaka ka Southern Hemisphere bad ka long ruh ka *pdeng liur* ha ki. Ha ki jaka kham shajan ia

u South Pole ki sngi ki nang jrong bad namar ba ki kjat sngi ki shat palat ia u te ha ki jaka kiba baroh sawdong ia u don 6 bnai ki sngi suda khlem miet, kata ka mut ba ka long ka *Midnight Sun*

Ha kita ki por ba *long liur* sha ki jaka ka Southern Hemisphere ka *long tlang* sha ki jaka ka Northern Hemisphere namar ki kjat sngi ki shat sharing sha ki, ki sngi shata ki lyngkot bad ha ki jaka u North Pole don tang ka jingdum suda 6 bnai bad ka 21st December ruh ka long ka sngi kaba lyngkot tam sha ki. Ha London ha kata ka tarik ka Sngi ka mih 8.6 A.M. bad ka sep 3.51 P.M.; kumta ki ioh sngi tang kumba 8 kynta bad miet 16 kynta. Ka Sngi i kumba ka sangeh shipor ha ki jaka u Tropic of Capricorn bad ia kata ka por ki khot *Winter Solstice*.

Hadien katei ka tarik ka Sngi ka phai ban mih pat na ki jaka kiba sha mihngi thik; kumta ka iai long man ka snem. Dei tang ha ki jaka u Equator ba ki sngi bad ki miet ki iaryngkat baroh shisnem.

**Ka jingiadei hapdeng ka jingshit ka Sngi bad ka sla ka pyrthei.**

Haba ka Sngi ka ieng beit ha ka suin (is highest in the heavens) ki kjat sngi ki hap beit (perpendicularly) ha ki katto katne ki jaka ka sla ka pyrthei bad ha kita ki jaka ka jingshit ka jur, katba ha kiwei pat ki jaka ha kiba ka Sngi ka ieng pyrshing (is lower) ki kjat sngi ki hap sharing bad kumta ka jingshit ha ki ka duna. Kane ka long namar haba ka Sngi ka ieng beit ki kjat sngi ki sam lyngba ia *ka lyer bad ki lyoh (atmosphere)* ki bym da rben eh (less atmosphere) bad kumta kim duna bor eh; hynrei haba ka Sngi kam ieng beit ki kjat sngi ki hap sharing bad ki sam lyngba ia ka atmosphere kaba rben (dense), haba kumta ki kham duna jingshit.

Ban kham sngewthuh shai ia kane ki ju bynta ia ka Globe ha ki line ba shu tharai. Ia kano kano ka circle la bynta ha ki  $360^\circ$ , kumta ki jaka baroh sawdong ia ka Globe ki long  $360^\circ$ . Ka jingjngai na u North sha u South Pole (ba ka long ka semicircle) ka long shiteng na ka Circumference ne na ka jingjngai baroh sawdong u Equ-

tor, ha kata ka rukom ka long  $180^\circ$  na u Pole sha u Pole tang ba ki khein  $0^\circ$  ha u Equator bad  $90^\circ$  ha uwei uwei na ki Pole.

Ia ka jingjngai ka jaka shatei bad shathie na u Equator ki khot *Latitude* (*Latitude* = ka jingiar ne pyngkiang). Ia ki line pyllun ne ki panpoh ba la ring sawdong ia ka Globe shi degree degree shatei bad shathie ban ia parallel ia u Equator ki khot *Parallels of Latitude*. Ki ne ki Parallel katba ki nang kham shatei ne shathie ki nang kham lyngkot. Ha u Equator ym don *Latitude*.

Ia u Parallel of *Latitude* uba  $23\frac{1}{2}^\circ$  shatei na u Equator ki khot *Tropic of Cancer* namar u don sha pyrshah ka *Constellation Cancer*. Ia u Parallel of *Latitude* uba  $66\frac{1}{2}^\circ$  shatei na u Equator ne  $23\frac{1}{2}^\circ$  shathie na u North Pole ki khot *Arctic Circle*.

Ia u Parallel of *Latitude* uba  $23\frac{1}{2}^\circ$  shathie na u Equator ki khot *Tropic of Capricorn* namar u don sha pyrshah ka *Constellation Capricorn*. Ia u Parallel of *Latitude* uba  $66\frac{1}{2}^\circ$  shathie na u Equator lane  $23\frac{1}{2}^\circ$  shatei na u South Pole ki khot *Antartic Circle*.

Ia ki degree ki Parallel of *Latitude* namar ba ring ia ki tang shatei bad shathie na u Equator ki khot bad thoh N. (North) bad S. (South), kumne 21 N.,  $59^\circ$ S.

Ka jngai 12500 mile ( $25000 \div 2$ ) na u Pole sha uwei u Pole, kumta ka jingjngai shi degree, kata na uwei u Parallel of *Latitude* sha uwei pat, ka long 69 mile ( $12500 \div 180$ ).

Na kine ki Parallel lah ban sngewthuh ia ka jinglong ka jaka shaphang ka *jingshit bad jingkhriat*. Ia ki jaka shatei bad shathie ki bym jngai na u Equator la ong ba ki don ha ki '*Low Latitude*,' namar ba ka number ki degree haba thoh ka kham rit (kum  $17^\circ$ etc), bad ki long ki jaka kiba shit; ia ki jaka pat kiba jngai na u Equator bad kiba kham jan ia ki Pole la ong ba ki don ha ki '*High Latitude*' namar ba ka number ki degree haba thoh ka kham heh (kum  $55^\circ$ etc.) bad ki long ki jaka kiba khriat.

Ki *Zone* ki long ki bynta baheh bad ba pyllun ne ki panpoh bakhraw shibun ha kiba la bynta ia ka Globe kat kum ka *jingshit*, ka *jingsyaid bad ka jingkhriat ba ki ioh na ki kjat sngi*. Ia ki pud jong ki *Zone* la pynthikna na ka

jingieng beik ki kjat sngi ha ka por shiteng sngi (midday altitude). Ka ktien *Zone* ka mut *panpoh*.

Ka Sngi ka ieng beik ha suin ha ka shisnem tang ha ki jaka ba hagdeng u Tropic of Cancer bad u Tropic of Capricorn, u Equator u da long hagdeng. Ia kine ki jaka, bad khyndew bad duriaw, ki khot *Torrid Zone* lane *The Tropics*. U *Torrid Zone* u iar naduh  $23\frac{1}{2}^{\circ}$  N. L. shaduh  $23\frac{1}{2}^{\circ}$  S. L., kata  $47^{\circ}$  lane kumba 3240 mile bad ki jaka ha u ki long ki bashit tam. Ka ktien *Torrid* ka mut *ba shit tyrkhong*.

Haba ka Sngi ka ieng beik ha u Tropic of Capricorn ki kjat sngi kim lah ban poi palat ia u  $66\frac{1}{2}^{\circ}$  North Latitude; ia u line pyllun sawdong ia uta u Latitude ki khot Arctic Circle. Na une u line sha u North Pole ka jlan  $23\frac{1}{2}^{\circ}$  ne kumba 1620 mile; ki khot ia kata ka jaka *North Frigid Zone* bad ka long kaba khriat tam. Ka ktien *Frigid* ka mut *bakhriat*.

Haba ka Sngi ka ieng beik ha u Tropic of Cancer ki kjat sngi kim lah poi palat ia u  $66\frac{1}{2}^{\circ}$  South Latitude; ia u line pyllun sawdong ia uta u Latitude ki khot Antarctic Circle. Na une u line sha u South Pole ka jlan  $23\frac{1}{2}^{\circ}$  ne kumba 1620 mile; ki khot ia kata ka jaka *South Frigid Zone* bad ka long ka bakhriat tam.

Ki jaka hagdeng  $23\frac{1}{2}^{\circ}$  N. L. bad  $66\frac{1}{2}^{\circ}$  N. L. bad hagdeng  $23\frac{1}{2}^{\circ}$  S. L. bad  $66\frac{1}{2}^{\circ}$  S. L. kim da shit ne khriat eh tang ba ki jaka ba shajan u *Torrid Zone* ki kham shit bad kiba shajan ki *Frigid Zone* ki kham khriat; ia khot ia ki namarkata *North bad South Temperate Zones*, kawei kawei na kine ki *Zone* ka jlan  $43^{\circ}$  ne kumba 2960 mile.

Kumta don 5 tylli ki *Zone*—*Torrid Zone*, *North Temperate Zone*, *North Frigid Zone*, *South Temperate Zone* bad *South Frigid Zone*.

*Kumno ban shem ia u Latitude jong kano kano ka jaka?*

1. *Na u Pole Star*. Ki briew kiba shong ha ka Northern Hemisphere ki lah ban shem ia u Latitude ka jaka na u Pole Star. Ha ki miet ki bashai bha, na u Equator lah ban iohi ba u Pole Star u don ha ka horizon, na ka jaka kaba jngai 69 mile shatei na u Equator lah ban iohi ba u Pole Star u kiew  $1^{\circ}$  ha ka horizon bad kumta ter ter man ka 69 mile u kiew shi degree degree haduh ba ha u North Pole

iohi ba u ieng beit  $90^\circ$ . Te lada na kano kano ka jaka iohi ba u Pole Star u kiew  $25^\circ$  haneng ka horizon kata la sngewthuh ba u Latitude kata ka jaka u long  $25^\circ$  N. L. Ki briew kiba ha ka Southern Hemisphere ki lah ban tip ia ka Latitude kano kano ka jaka da kaba khein ia ka jing-jngai ia man 69 mile shaphang shathie na u Equator ba ka long  $1^\circ$

2. *Na ka Sngi.* Kata da kaba thew na ka syrngiew ia ka jingkhun ne ka angle ka jingieng beit (altitude) ka Sngi ha kata ka jaka ha ka por shiteng sngi bad da kaba subtract ia ka na ka  $90^\circ$  kaba long ka altitude ka Sngi haba ka ieng beit thik. Lada ka altitude ka Sngi ha ka por shiteng sngi ha kano kano ka jaka ka long  $36^\circ$  ngi sngewthuh ba kata ka jaka ka long  $54^\circ$  North ne South na u Equator, namar  $90^\circ - 36^\circ = 54^\circ$ .

*Balei ba ki jaka kiba shajan ki Pole kim ioh katjuh kajingshit kumba ioh ki jaka kiba shajan u Equator?* Ki jaka kiba kham jan ia u Equator ki kham at, ki kjat sngi, te (1) ki hap beit (perpendicularly) ha ki, (2) ki sam lyng-ba ruh ia ka haw haw kaba kham stang (less atmosphere) bad (3) ki hap saphriang ruh ha kham khyndiat ka jaka (surface area), namarkata ki jur ka bor ban ai jingshit; te kita ki jaka ki kham shit. Ki jaka kiba shajan ki Pole ki kham noh padun, ki kjat sngi te (1) ki hap sharing (slantingly) ha ki, (2) ki sam lyngba ruh ia ka haw haw ba kham rben (greater thickness of atmosphere) bad (3) ki hap saphriang ruh ha kham bun ka jaka (surface area), namarkata ki duna ka bor ban ai jingshit; te kita ki jaka ki khamkhriat.

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Namar ba ka pyrthei ka pyllun ki jaka ha ki liang jong ka baroh kim ia ioh sngi bad ia ioh miet ha kajuha ka por, kata ka mut ki por ka baje kim iadei kijuh, hynrei haba ka long mynstep ha kiwei ki jaka ka long 7, 10, 12, 3 baje etc. ha kiwei pat ki jaka.

La ring te ha ka Globe ki line kiba long shiteng pyllun (half circle) da pynieng na u North sha u South Pole, ia kita ki line ki khot *Meridians* ne *Lines of Longitude* Meridian = midday; Meri = pdeng, dies = sngi, namar ki jaka

baroh ha kita ki line naduh North shaduh South Pole ki ia long ryngkat shiteng sngi ne ki ialong baroh katjuh baje ha kajuh ka por. Ban bit ka jingkhain por ki shim ia u Meridian kano kano ka jaka ba un long uba nyngkong na uba yn sdang ñiew. Ha ka hima British la shim ia u Meridian uba iaid lyngba ia ka Greenwich ba un long u Prime ne first Meridian.

Ia ka jingjngai sha mihngi ne sepngi na u Prime Meridian ki khot *Longitude* ( $\text{Longitude} = \text{pynieng}$ ).

Namar ba la bynta ia ka Globe  $360^\circ$  bad namar ba ka Pyrthei ka rotate ia kita ki degree baroh ha ka 24 kynta, namarkata ka jingiapher ka por ki baje ha ki jaka ka long  $15^\circ$  man ka kynta ( $360 \div 24$ ) ne  $1^\circ$  man ka 4 minit ( $24 \times 60 \div 360$ ) ; bad namar ba ka pyrthei ka rotate na West shu East kumta ka por kaba sha West na Greenwich, kata sha kadiang ka Globe ne Map, ka kham step ne kham duna (behind time) ia ka por ha Greenwich, bad ki jaka sha East na Greenwich, kata kiba sha kamon ha ka Globe ne ka Map ki long sha khmat ne kham palat (advance time) ia ka por ha Greenwich. Tharai ka por ha Greenwich ka long 1 P. M. te ka por ha ka jaka kaba  $15^\circ$  W. ka long 12 baje bad ha ka jaka kaba 15 E. ka long 2 P. M., ne lada ka long 12 baje ha Greenwich, ha New Orleans kaba long  $90^\circ$  W. ka long 6 A. M. bad ha Dacca kaba  $90^\circ$  E. ka long 6 P.M. Kumjuh kaba shim ia u Longitude kano kano ka jaka dei ban sngewthuh ba ka por ha ki jaka kiba sha West jong ka ka kham duna (behind) bad ka por ha ki jaka kiba sha East jong ka ka kham palat (in advance of) ia ka por ha ka.

Don  $360^\circ$  ki Meridian na u North sha u South Pole; ki khein  $0^\circ$  na Greenwich bad  $180^\circ$  sha East bad  $180^\circ$  sha West na ka. Ka jingjngai shi degree u Longitude ha u Equator ka long 69 mile ( $2500 \div 360$ ) tang ba katba ki Meridian ki nang jan ia ki Pole ki nang rit bad nang iajan. kumta ka jingjngai hapteng jong ki ka nang duna ia ka 69 mile haduh ba ha ki Pole ym don Longitude.

Ia ki degree ki Meridian of Longitude namar ba ring ia ki tang sha mihngi bad sepngi na u Prime Meridian ki khot bad ki thoh E. (East) bad W. (West), kumne  $37^\circ$  E.,  $85^\circ$  W.

Ka por ha ki jaka kiba ha ujuh u Meridian ka iadei



kajuh wat la kim long ha ujuh u Latitude. Ka por ha Madras ( $13^{\circ}\text{N.}$ ) ka long kajuh bad ka por ha Cawnpore ( $27^{\circ}\text{N.}$ ) namar ki ialong ha ujuh u Longitude uba  $80^{\circ}\text{E}$  ne ka por ha St. John ( $48^{\circ}\text{N.}$ ) ka long kajuh bad ka por ha Monte Video ( $35^{\circ}\text{S.}$ ) namar ki ialong ha ujuh u Longitude uba  $56^{\circ}\text{W.}$  Hynrei ka por kaba ha ki jaka kiba ha u juh u Latitude kam ialong katjuh, ka iapher. Ka Madras bad Mangalore ki long ha ujuh u Latitude  $13^{\circ}\text{N.}$ , hynrei namar ba u Longitude ka Mangalore u long  $75^{\circ}\text{E.}$  bad u jong ka Madras  $80^{\circ}\text{E.}$  kumta ka jingiapher ka por hapdeng jong ki ka long kumba 20 minute ( $80^{\circ}-75^{\circ}=5^{\circ}$ .  $5 \times 4 = 20$  minute).

*Kumno ban shem ia u Longitude kano kano ka jaka, bad ruh kumno ban shem ia ka jingiapher ki por ha kino kino ki jaka?*

Ia kane lah ban shem da kaba khein ia ka jingiapher ka por ha Greenwich bad ka por kata ka jaka haba khmih na ka jingkieu jingnoh ka sngi, khamtam ha ka por shi-teng sngi. Ia ka por ha Greenwich lah ban tip da kaba phah telegraph ban kylli na Greenwich lane da kaba khmih ia ki kynja baje babha kiba ki khot *Chronometer* kiba la pynbiang lpa thik bad ka por ha Greenwich. Haba la tip ia ka jingiapher ka por lah ban pynthikna katno Longitude kata ka jaka ka long sha East ne West na Greenwich da kaba khein  $15^{\circ}$  ka jingiapher man ka kynta. Da kajuh ka rukom lah ban shem ia ka jingiapher ki por kino kino ki jaka haba la ai ia ka jingiapher ki Longitude hapdeng jong ki.

1. Lada ka long 4.20 p. m. ha kawei ka jaka haba ka long shiteng sngi ha Greenwich katno u Longitude kata ka jaka?

Ka jingiapher ka local time (hapdeng kitei ki jaka) ka long 4 kyn. 20 min.  $\therefore$  ka jingiapher u Longitude ka long kyn kyn

$$1 : 4\frac{1}{2} :: 15^{\circ} : x. \therefore x = 13 \times 5 = 65^{\circ}$$

Namar ba ka por ha kata ka jaka ka sha khmat ia ka por ha Greenwich, te kata ka jaka ka long  $65^{\circ}\text{E.}$  Ans.

2. Ka long shiteng sngi ha kawei ka jaka; haba khmih ia ka Chronometer shem ba ka por ha Greenwich ka long 3.25 P. M.; katno u Longitude kata ka jaka?

Ka jingiapher ka local time ka long 3 kyn. 25 min.

Ka jingiapher u Longitude ka long  $3\frac{5}{8} \times \frac{1}{4} = \frac{4\frac{1}{2}}{1\frac{1}{2}} \times \frac{1}{4} = 2\frac{3}{4} = 51^{\circ} 15'$ .

Namar ba ka por ha kata ka jaka ka hadien ia ka por ha Greenwich, te kata ka jaka ka long  $51^{\circ} 15' W$ . ANS.

3. Katno u Longitude ka jaka kaba ka por ha ka ka long 11 min. 20 sek. hadien (behind) ka por ha Greenwich?

Min. Min.

$4 : 11\frac{1}{2} :: 1^{\circ} : x$ .  $x = \frac{3}{8} \times \frac{1}{4} = \frac{17}{8} = 2^{\circ} 50'$ .

Namar ba ka por ha kata ka jaka ka hadien ia ka por ha Greenwich, te kata ka jaka ka long  $2^{\circ} 50' W$ . ANS.

4. Ka jingiapher ka local time hagdeng ar tylli ki jaka ka long 2 kynta 18 min. U Longitude kawei ka jaka u long  $44^{\circ} 32' E$ . Katno u Longitude kawei pat ka jaka?

Ka jingiapher ka local time ka long 2 kynta 18 min.

$\therefore$  Ka jingiapher u Longitude ka long

$2\frac{3}{4} \times \frac{1}{4} = \frac{2\frac{3}{4}}{1\frac{1}{2}} \times \frac{1}{4} = \frac{6}{4} = 34^{\circ} 30'$ .

Lada kawei ka jaka ka long sha East jong kata ka jaka ba la ai, te u Longitude jong ka u long  $44^{\circ} 32' + 34^{\circ} 30' = 79^{\circ} 2' E$ . ANS.

Lada kawei pat ka jaka ka long sha West jong kata ka jaka ba la ai, te u Longitude jong ka u long  $44^{\circ} 32' - 34^{\circ} 30' = 10^{\circ} 2' E$ . ANS.

5. U briew haba u poi ha kawei ka jaka u shem ba ka baje jong u ka suki (behind) 37 min ia ka por kata ka jaka. Sha kano ka phang u la ia id bad katno u Longitude kata ka jaka ba u poi?

Namar ba ka por ha kata ka jaka ka long sha khmat

ia ka por ka baje jong u, te kata ka jaka ka long sha East.  
min. min.

$$4 : 37 :: 1^\circ : X. X = \frac{37}{4} = 9^\circ 15' \text{ E. Ans.}$$

6. Da kaba telegraph na Cape Town sha Greenwich  
la shem ba ka por ha ka palat (advance) 1 kyn. 14 min.  
20 sek. ia ka por ha Greenwich. Katno u Longitude kata  
ka jaka?

Ka jingiapher ka local time ka long 1 kyn. 14 min. 20 sek.  
=  $1 \frac{43}{180}$  kyn.

∴ Ka jingiapher u Longitude ka long

$$1 \frac{43}{180} \times \frac{15}{1} = \frac{223}{180} \times \frac{15}{1} = \frac{223}{12} = 18^\circ 35'.$$

Namar ba ka por ha Cape Town ka long sha khmat  
(advance) ia ka por ha Greenwich, te ha Cape Town ka  
long  $18^\circ 35' \text{ E. Ans.}$

7. Haba khmih ia ka Chronometer na ka jaka kaba  
 $13^\circ \text{W.}$  shem ba ka por ha Greenwich ka long shiteng  
ngi. Katno ka por ha kata ka jaka?

Ka jingiapher u Longitude ka long  $13^\circ$

∴ Ka jingiapher ka por ka long  $1^\circ : 13^\circ :: 4 \text{ min.}$   
: x. ∴  $x = 13 \times 4 = 52 \text{ min.}$

Namar ba ka jaka ka long sha West na Greenwich ka  
por ha ka ka long hadien (behind) ia ka por ha Greenwich,  
te = 12 baje — 52 min. = 11.8 A.M. Ans.

8. Lada ka long shiteng ngi ha Calcutta kaba  $88^\circ$   
 $27' \text{ E.}$  wad ia ka por (1) ha Greenwich bad (2) ha Shillong  
kaba  $91^\circ 53' \text{ E.}$

(1) Ka jingiapher u Longitude hagdeng Calcutta  
bad Greenwich ka long  $88 \frac{27}{60}^\circ$  —  $88 \frac{9}{10}^\circ$ . Namarkata ka jing-  
iapher ka por ka long  $15^\circ : 88 \frac{9}{10}^\circ :: 1 \text{ kyn} : x = \frac{1769}{40 \times 10} =$   
 $1 \frac{769}{400} \text{ kyn} = 5 \text{ kyn. } 53 \text{ min. } 48 \text{ sek.}$

Namar ba ka Greenwich ka long sha West ka Calcutta

te ka por ha ka ka long hadien ia ka por ha Calcutta = 12 bajé—5 kyn. 53 min 48 sek.=6 kyn. 6. min. 12 sek. = 6. 6. 12 A. M. ANS.

(2) Ka jingiapher u Longitude hapteng Calcutta bad Shillong ka long  $91^{\circ} 53' - 88^{\circ} 27' = 3^{\circ} 26' = 3\frac{26}{60}$ .

Namar kata ka jingiapher ka por ka long  $1^{\circ} : 3\frac{1}{2}\frac{30}{0} :: 4 \text{ min} : x. \therefore x = \frac{3\frac{1}{2}\frac{30}{0}}{30} \times \frac{4}{1} = \frac{200}{15} \text{ min. } 13 \text{ min. } 44 \text{ sek.}$

Namar ba ka Shillong ka long sha East na Calcutta te ka por ha ka ka long sha khmat ia ka por ha Calcutta = 12 bajé + 13 min. 44 sek. = 12. 13. 44. P. M. ANS.

9. Shem ia ka por ha New York haba ka long 7 A. M. ha Patna. U Longitude ka Patna u long  $85^{\circ} 15' \text{ E.}$  bad u jong ka New York  $73^{\circ} 58' \text{ W.}$

Namar ba ka Patna ka don sha East na Greenwich bad ka New York sha West, te dei ban add lang ban shem ia ka jingiapher u Longitude =  $85^{\circ} 15' + 73^{\circ} 58' = 159^{\circ} 13'.$

Namar kata ka jingiapher ka por ka long  $15^{\circ} : 159\frac{13}{60} :: 1 \text{ kyn. } x. \therefore x = \frac{9\frac{55}{60}\frac{3}{15}}{60 \times \frac{3}{15}} \text{ kyn. } = 10 \text{ kyn. } 36 \text{ min. } 52 \text{ sek.}$

Bad namar ba ka New York long sha West ka Patna kumta ka por ha ka ka long hadien ia ka por ha Patna ; te ka long  $12+7=19$  kynta—10 kyn. 36 min. 52 sek. = 8. 23. 8. P.M. kum Mynhynnien. ANS.

10. Ka Madras ka long  $85^{\circ} 15' \text{ E.}$  Katno ka jingiapher ka por hangta bad ka por (1) ha Bombay kaba  $70^{\circ} 45' \text{ E.}$  bad (2) ha Tokio kaba  $140^{\circ} \text{ E. ?}$

(1) Ka jingiapher u Longitude hapteng Madras bad Bombay =  $80^{\circ} 15' - 70^{\circ} 45' = 9^{\circ} 30'.$  Namar kata ka jingiapher ka por ha long  $1^{\circ} : 9\frac{1}{2} :: 4 \text{ min. } : x. \therefore x = \frac{1\frac{1}{2}}{9} \times \frac{4}{1} = 38 \text{ min.}$  Ka por ha Bombay ka long 38 min. hadien ia ka por ha Madras. ANS.

(2) Ka jingiapher u Longitude hapteng Madras bad Tokio =  $140^{\circ} - 80^{\circ} 15' = 59^{\circ} 45'.$  Namar kata ka jingia-

pher ka por ka long  $15^{\circ} 59\frac{3}{4}^{\circ} :: 1 \text{ kyn.} : x. \therefore x = \frac{2\frac{3}{4}}{4 \times 1\frac{1}{2}} = \frac{3\frac{3}{4}}{6} = 3 \text{ kyn. } 59 \text{ min.}$  Ka por ha Tokio ka long 3 kyn. 59 min. sha khmat ia ka por ha Madras. ANS.

11. Ka footbal match kaba ialeh ha Sydney kaba  $151^{\circ} 15' \text{ E.}$  ka kut ha ka por 6.20 P.M. La phah telegraph sha London ban pyntip ia ka result. Ha katno ka por kin ioh ha London?

Ka jingiapher u Longitude hapdeng Sydney bad London  $= 151^{\circ} 15'$ . Namarkata ka jingiapher ka por ka long  $15^{\circ} 151\frac{1}{2}^{\circ} :: 1 \text{ kyn. } x : x = \frac{600}{4 \times 1\frac{1}{2}} = \frac{600}{8} \text{ kyn.} = 10 \text{ kyn. } 5 \text{ min.}$

Namar ba ka London ka long sha West na Sydney te ka por ha ka kan long hadien ia ka por ha Sydney  $= 12 + 6 \text{ kyn. } 20 \text{ min.} = 18 \text{ kyn. } 20 \text{ min.} - 10 \text{ kyn. } 5 \text{ min.} = 8. 15 \text{ A.M. ANS.}$

12. La phah telegraph na Kingston kaba  $76^{\circ} 22' 30'' \text{ W.}$  sha London ha ka por 10. 40. A.M. Lano kin ioh ha London, tharai ba ka telegraph ka ia id 15 min?

Ka jingiapher u Longitude hapdeng Kingston bad London  $= 76^{\circ} 22' 30'' = 76\frac{3}{8}^{\circ}$ .

Namar kata ka jingiapher ka por ka long  $15^{\circ} : 76\frac{3}{8}^{\circ} \times 1 \text{ kyn.} : x. \therefore x = \frac{6}{8 \times 1\frac{1}{2}} = \frac{6}{1\frac{1}{2}} = 5 \text{ kyn. } 5 \text{ min. } 30 \text{ sek.}$

Hynrei ka shim por ia ka telegraph 15 min. ban poi ; te ka long 5 kyn. 5 min. 30 sek. + 15 min = 5 kyn. 20 min. 30 sek. Namar ba ka London ka long sha East na Kingston, te ka por ha ka kan long sha khmat ia ka por ha Kingston.

$= 5.20.30 + 10. 40. = 16.0.30 - 12 = 4. 0. 30. \text{ P. M. ANS.}$

13. Na ka jhad ha ka por shiteng synñia la iohi ba u Pole Star u don  $49^{\circ}$  sha jrong na ka horizon bad shem ruh na ka Chronometer ba ka por ha Greenwich ka long 3. 33. A.M. Ha uno u Latitude bad u Longitude kata ka jhad ka don?

1. Namar ba u Pole Star u don  $49^{\circ}$  na ka horizon

kumta u Latitude kata ka jaka u long  $49^\circ$  N.

2. Ka jingiapher ka local time ka long  $12 + 3.33 = 15.33$ .  $15.33 - 12 = 3.33$  kynta; namarkata u Longitude u long.

$$3\frac{1}{2} \times \frac{1}{4} = \frac{3}{2} \times \frac{1}{4} = \frac{3}{8} = 53^\circ 15'.$$

Namar ba ka por ha kata ka jaka ka long hadien ia ka por ha Greenwich te kata ka jaka ka long sha West na Greenwich. Te ka jhad ka don ha u Lat.  $49^\circ$  N. bad u Long.  $53^\circ 15'$  W. ANS.

Ia ki artylli ki jaka ne ki *point* ha ka sla ka Pyrtthei kiba ia marpyrshah beit thik haba ia ieng para kjat (diametrically) ki khot *Antipodes*.

*Haba la ai ia u Latitude bad u Longitude kano kano ka jaka ban shem ia u Latitude bad u Longitude ka Antipodes.* Ka rukom khein ka long :— Shu pynkylla ia ka phang (direction) u Latitude jong ka jaka ba la ai yn shem ia u Latitude ka Antipodes; subtract ia u Longitude kata ka jaka ba la ai na ka  $180^\circ$ , sa pynkylla ia ka phang (direction) un long u Longitude ka Antipodes.

1. U Latitude ka Shillong u long  $25^\circ 34'$  N. bad u Longitude  $91^\circ 53'$  E. Katno u Latitude bad u Longitude ka Antipodes jong ka?

$\therefore$  Namar ba u Latitude ka Shillong u long  $25^\circ 34'$  N., te u Latitude ka Antipodes jong ka u long  $25^\circ 34'$  S.; bad namar ba u Longitude ka Shillong long  $91^\circ 53'$  E. te u Longitude ka Antipodes jong ka u long  $180^\circ - 91^\circ 53' = 88^\circ 7'$  W.

Lat. =  $25^\circ 34'$  S.; Long. =  $88^\circ 7'$  W. ANS.

2. Ka jaka ka don ha u Equator ha u Longitude  $15^\circ 32'$  W. Katno u Latitude bad u Longitude ka Antipodes?

Namar ba ha u Equator ym don Latitude kata  $0^\circ$ , te u Latitude ka Antipodes ruh u long  $0^\circ$  hi; bad namar ba u Longitude ka jaka u long  $15^\circ 32'$  W. te u Longitude ka Antipodes u long  $180^\circ - 15^\circ 32' = 164^\circ 28'$  E.

Lat. =  $0^\circ$ ; Long.  $164^\circ 28'$  E. ANS.

*Zenith* ka long ka jaka ne ka *point* ha suin kaba ha

neng thik ki khlieh jong ngi.

*Nadir* ka long ka jaka ne ka *point* ha suin sha kawei pat ka liang ka Pyrthei kaba pyrshah thik ia ki kjat jong ngi.

Ka Zenith ha ki Antipodes ka long ka Nadir jong ngi bad ka Zenith jong ngi ka long ka Nadir jong ki.

*Ka Syrngiew*—Ia ki jaka u Equator, u Tropic of Cancer, Arctic Circle, Tropic of Capricorn, Antarctic Circle lah ban pynthikna na ka syrngiew ki kjat sngi. Ha ka Torrid Zone ne ki Tropics ka Sngi ka ieng beit ha ka Zenith ha ka por shiteng sngi (noon), namarkata don ki jaka ha kata ka Zone ha la ki sngi ki sngi ha kiba kiei kiei kim shat syrngiew ha ka por shiteng sngi.

Kumta ha ka por shiteng sngi :—

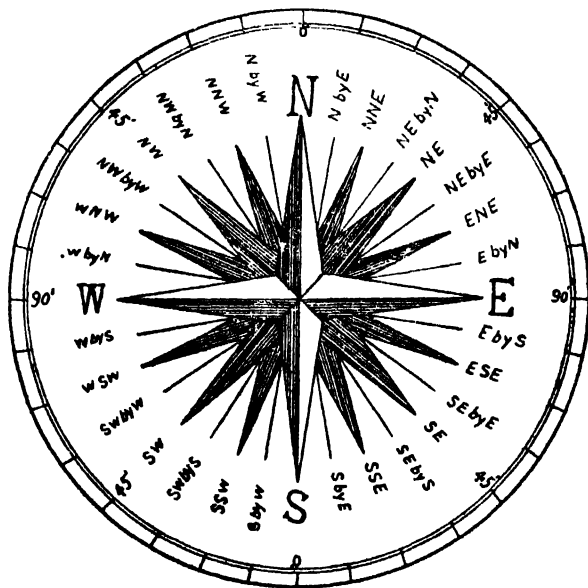
1. Ha u Equator ym don syrngiew ha u March 21 bad September 23.
2. Ha u Tropic Cancer ym don syrngiew ha u June 21.
3. Ha u Tropic of Capricorn ym don syrngiew ha u December 21.

Ha ki Temperate Zone ka Sngi kam ju ieng beit thik ha ka Zenith ha ka por shiteng sngi; kumta ha ki don syrngiew barobor.

Ka jingjrong bad jinglyngkot ka syrngiew ka shong kat kum ka jinghap beit ne jinghap kynriang (altitude) ki kjat sngi. Haba ki sngi ki shat beit ka syrngiew ka lyngkot, haba ki shat kynriang ka syrngiew ka jrong; ha ka por shiteng sngi ka syrngiew ka kham lyngkot bad ha ka por tlang ba ki kjat sngi ki kham shat sharing ka syrngiew ka kham jrong. Ha Calcutta, Dacca, Shillong ki jaka kiba kham jan ia u Tropic of Cancer ka syrngiew ha ka por shiteng sngi ka lyngkot tam ha u June 21 bad ka jrong tam ha u December 21.

*The Mariner's Compass.* Kane ka long ka tiar na kaba ki nongpyniaid jhad ki lah ban tip ia ki saw tylli ki

dong ba kongsan (the four cardinal points) haba ki don ha duriaw bah wad lada kim iohi ia ka Sngi ne ki Khlur. Ki ju thaw ia ka da ka kot rben kaba la pynshong ha ka kynja tin stang ba pyllun (disc of card board) ha kaba la buh dak ia ka North, East South bad West. Ha kata ka cardboard ba pyllun, ba ka long ka circle, ki buh  $360^{\circ}$ . Ia ka jaka hagdeng kawei kawei na kitei ki cardinal points kaba long  $90^{\circ}$  la bynta ha ki 8 bynta ba ia ryngkat bad



don 7 tylli ki dak ba la ruid ban kdew ia kata. Kumta don 32 ki bynta ba ia ryngkat ha baroh sawdong kata ka card board, te don  $11\frac{1}{4}^{\circ}$  ( $360^{\circ} : 32$ ) hagdeng iwei iwei i bynta barit. Ia kata ka disc la pynsnoh ha u *Thyrnia magnet* (Magnetic Needle) uba kdew barobor sha North bad South kata haba u ring ia kata ka card board ryngkat bad kaba kdew sha ka dak North la sngewthuh ba sha kita ki phang don u North Pole. U Magnetic Needle um da



kdew beit eh sha u North Pole, hynrei sha ka jaka ba ki khot Magnetic Pole kaba don ha kawei na ki Island ba shaphang shatei ka North America ha u Lat.  $70^{\circ} 51' N$ . bad u Long.  $96^{\circ} 46' W$ .

*U Bnai ne Moon*—Kum ka Pyrthei jong ngi U Bnai, uba long u Satellite jong ka, um don jingshai ha lade; u shai mynmiet namar ba u pynphalang ia ka jingshai ba u ioh na ka Sngi. U Bnai ruh u don ar jaid ki jingshad sawdong;—u rotate ha la u axis bad u revolve sawdong ia ka pyrthei; bad namar ba u bud ryngkat ia ka Pyrthei da kaba shad ia iaaid sawdong ia ka katba ka ruh ka shad ia iaaid sawdong ia ka Sngi namarkata u paw tang da kajuh ka liang sha ngi kiba shong ha ka Pyrthei. U i kumba u heh kat ka Sngi namar ba u kham jan ia ka Pyrthei jong ngi; ka jingjingai na ka sha u ka long tang 24000 mile. Ka shim por ia u kumba 28 sngi (27 sngi bad 8 kynta) ban pyndep ia la ka revolution sawdong ia ka Pyrthei, bad lada ka Pyrthei ka neh ha kajuh ka jaka kata dei ban khein ba shi bnai (lunar month) ka long kat kitei ki sngi; hynrei namar ba ka Pyrthei ha kajuh ka por ka shad ia iaaid sawdong ia ka Sngi te ka shim por ia u haduh kumba  $29\frac{1}{4}$  sngi ban poi biang ha ka jaka ne ka point kaba pyrshah beit ia ka Sngi, na kaba u la mih nyngkong, kata ka mut naduh ba u pyllun haduh ba un da pyllun pat ne naduh ba u mih haduh ba un da mih pat ka long kumba  $29\frac{1}{4}$  sngi, bad kata ka long shi bnai (lunar month).

Ka Pyrthei ka pyndep ia la ka revolution sawdong ia ka Sngi ha ka 365 sngi bad 6 kynta ne 1 snem, kata ka mut kumba 12 tylli ki lunar month. Hynrei 12 sien ki  $29\frac{1}{4}$  sngi long tang 354 sngi ( $12 \times 29\frac{1}{4} = 354$ ), te ban ia biang ki sngi jong katei ka shi snem ne 365 sngi bad 6 kynta la add  $\frac{1}{4}$  sngi ha ki saw ki bnai (kata kiba long 30 sngi), shi sngi shiteng pat ha ki hynñiew ki bnai (kata kiba long 31 sngi) bad la buh tang 28 sngi ha uwei u bnai; kumta ka long 365 sngi baroh. Itei i 6 kynta ba dang sah ha ka shi snem, ha man la ka 4 snem i long shi sngi ( $4 \times 6 = 24$  kynta): la add te ia kata ka shi sngi ha man la ka snem kaba saw ha u bnai uba 28 sngi (kata u long 29

sngi), bad ia kaba kum kata ka snem la khot *Leap year*,

Ki *Tide* ne ki *Tidal waves* ki long ki jingkhiih man ka sngi jong ki um ka duriaw ha ki por bathikna (regular).

Ia kine ki jingkhiih la pynlong na ka jingring u Bnai bad ka Sngi ia ka Pyrthei; khamtam na ka jingring u Bnai namar u khamjan ia ka. U Bnai namar ba u khamrit ruh um kham lah ban ring ia ka Khyndew (Solid Earth), u kham ring bad kham pynkhiih ia ki Um ba ki jem (Liquid Ocean).

Haba ki um ki tur bad ki ieng sha ryngkew ki khot *High Tide* bad haba ki kynran pat kham shapoh ia ka line ka duriaw ki khot *Low tide*.

U Bnai u ring jur ia ki Um ki bapyrshah beit ia u, bad u ring artat ia ka Khyndew (la ym da jur eh) u pynkhiih ruh ia ki jaka kiba sha lyndet jong u kiba don sha kawei pat ka liang ka Pyrthei kaba pyrshah ia kata ka jaka ba u ring, syriem kumba haba u khynnah rit u ring ia u rangbah na ka coat na khmat, ka bynta jong ka coat ruh kaba shadien sha ka syngkai ka khiih wat lada u khynnah um don bor haduh ban ring pynkyllon ia u. Kumta don artylli ki High Tide ha kajuha por ha kita ki artylli ki jaka ba ia pyrshah, bad ha kajuha por ruh ha ki artylli ki jaka kiba hapteng kitei artylli ki jaka ba long High tide ka long Low tide, kata ha ki jaka kiba long *at right angles* ia u Bnai.

Bad namar ba ka Pyrthei ka rotate ha la u axis shi sien ha ka 24 kynta, ka pynphai hadien kumba 6 kynta ba kitei ki jaka kiba long marpyrshah bad sha lyndet ia u Bnai ba kin long *at right angles* ia u; ha kata ka por long Low Tide ha ki Hadien 6 kynta pat, kata hadien 12 kynta haba khein naduh ka jaka ne ka *point* ba shim nyngkong, la pynphai ia katei ka jaka kaba sha lyndet u Bnai ban phai pyrshah ia u bad haba kumta katei ka jaka pat kaba la don nyngkong pyrshah ia u ka poi sha ki jaka ba sha lyndet thik ia u, te long High Tide biang ha ki. Kumta don artylli ki High Tide bad artylli ki Low Tide man ka sngi ne man ka 24 kynta ha kajuha jaka, kata kawei ka

High Tide bad kawei ka Low Tide mynsngi bad kawei ka High Tide bad kawei ka Low Tide mynmiet.

Hynrei kajuh ka jaka kam ju ioh High Tide lane Low Tide ha kajuh ka por man ka sngi. Ka daw ka long namar ba u Bnai ba u kham rit u rotate bad revolve kham stet ban ia ka Pyrthei, u da revolve sawdong ia ka Pyrthei shisien ha ka 28 sngi. Kumta ka jingiapher ha kajuh ka jaka jong ka High Tide kaba mynta ka sngi bad ka sngi kaba bud ka long 24 kynta 51 min. ( $\frac{1}{8}$  of 24 kynta = 51 min.). Kumjuh ruh ka jingiapher hagdeng kawei ka High Tide mynsngi bad kawei pat ka High Tide mynmiet ka long 12 kyn. 25 min. 30 sec. (24 kyn. 51 min.  $\div$  2). Lada u Bnai u shu ieng ha kajuh ka jaka yn ym don jingiapher ei ei, kan shu long High Tide bad Low Tide ha kajuh ka jaka ha kajuh ka por hi man ka 24 kynta thik.

Ia ka jingkiew ka Tide na ka sla ka duriaw ne na ka Low Water ban pynlong High Tide ki khot *Flood Tide*; ka shim por kumba 6 kynta ba kan kiew kumta. Ia ka jinghiar ka Tide na ka High Water sha ka Low Water ki khot *Ebb Tide*; kane ruh ka shim por kumba 6 kynta.

Ha ka por ba mih (new) bad ba pyllun (full) bnai ka Sngi bad u Bnai ki ia don ha kajuh ka line, kumta ka bor ring ia ka Pyrthei sha kajuh ka liang ka kham khraw bad ha kiba kum kita ki por, kata shisien man la ka artaiew, don ki tide kiba kham jur ban ia kaba ju long kiba ki khot *Spring Tides*.

Haba u Bnai u long shiteng (*half-moon*), ka Sngi bad u Bnai ki iaieng mar shidong beit ne ki ia long *at right angles*, bad namar ba para ma ki hi ki iaring uwei ia kawei te ka bor ring jong ki ia ka Pyrthei ka kham duna bad ha kita ki por ki tide ki kham them ne duna ban ia kaba ki ju long; ki khot ia ki *Neap Tides*.

*Ki Phang sha kiba ki Tide ki kkih.* Lada yn don tang ka duriaw suda te ki tide ba ki bud ia u Bnai kin kkih na East sha West namar ba ka Pyrthei ka rotate na West sha East. Hynrei kam long kumta namar:—

(a) ba ka Jingjylliew ka duriaw kam long katjuh ha

ki jaka baroh; ki tidal waves ki kham khih stet ha ki jaka ba kham jylliew.

(b) ba ka don ka Ryngkew ka bym ryntih ha ka jingat jingthem ha baroh sawdong ki duriaw (configuration of the land). Ka jingat jingthem ka ryngkew harud duriaw ka khang ia ki Tide ba kumta baroh kim lah ban ia bud thik pyrshah ia u Bnai, hynrei ki bud ia u kham hadien khyndiat Kumta don ki jaka ha ki rud duriaw ha kiba ki um ki kiew shajrong (kata ki long high water) ha kajuh ka por. Ia ki *line* ba la ring ne buh dak ha ka Map kiba pyni ia ki jaka kiba ia ioh *high water* ha kajuh ka por ki khot *Co-Tidal Lines*. Ha ka South Pacific Ocean ha ka bym don bun ka khyndew ki tidal waves ki khih ha ka rukom ba ryntih na North sha South, bad ki co-tidal lines ki kham khun shaphang North. Ha ka Atlantic Ocean kaba ka ryngkew ka ker baroh sawdong kham najan, ki tide ki kham khih na West shaphang Northern Europe.

Dei tang ha ki por new bad full moon haba ka Sngi bad u Bnai ki ia don ha kajuh ka line ba ki tide ki kham bud beit ia u Bnai namar ka bor ring jong u ka kham khraw ba ka iarap ka jingring ka Sngi de.

*Ka jingjrong ki Tide.* Hapdeng duriaw ki tide ki kiew tang 2 ne 3 ft. bad kiba shong ha ki jhad kim sngew-thuh ia kata. Ha ki duriaw bajyndon bad ki kyndong duriaw ne ki River mouth ki barat ka shyntur kum ka shar, namar ba ka trai duriaw ka jyndong ka bynta ka tide kaba wan nyngkong ka kham suki bad ynda wan lap ka bynta kaba hadien ka kynting ia ki ba kin kiew sha jrong eh... Ha ka Bay of Fundy ha Nova Scotia ka kiew 60 ft., ha British Isles hapdeng 40 bad 50 ft., ha Calcutta 11 ft., ha Chittagong 13 ft., ha Rangoon 16 ft., shaphang Bombay 13 ft., bad ha Gulf of Cambay 30 ft. palat.

Ha ki Kyndong duriaw bad ki River mouth kiba da kham khim bha ki tide ki tur kham stet, ki kyrhuh jam bad ki ieng kum ka kynroh ki da khang shipor ia ka lynti ka River. Ia kita ki Tide bakyrhuh ki khot *Bore*. Don ki Bore khamtam ha ka por ki Spring Tide ha Hugli, Seine,

Garonne, Amazon, Bay of Fundy. Ha Tsientang ha China ka Bore ka khiih bad tuid kumba 20 mile shi kynta bad ka ieng haduh 30 ft. palat ka jingjrong.

Ha ki Duriaw (Sea) kiba la ker baroh sawdong da ka ryngkew bad ki bym don lynti um ki baheh (kum ka Mediterranean, Baltic, Black Sea), ki tidal waves kim lah ban rung bad ha kiba kum kita ki duriaw lajan bym don tide ei ei.

*Ki jingmyntoi na ki Tide:—*

1. Ki iarap ia ka khaii pateng. Ki Tide ki pynjyl-liew ia ki River mouth ba kunta ki jhad khaii ki lah ban mih bad poi suk ha ki Port.

2. Ki pynkhuid ruh ia ka ktieh kaba wallam ki river sha duriaw ba kumta ym don jingkhang (ne Bars) ban pynwit ia ki jhad haba ki iaiaid.

3. Ki khang ia ki um ka duriaw na ka ban kylla thah namar ki pynkhih barobor ia ka um bad ruh ki pyn-iakhleh ia ki um mluh ka duriaw bad ki um sngur kiba wan hap na ki River.

## PHYSICAL GEOGRAPHY.

Kumba la ong sha khmat ka Pyrthei ha kaba mynnyng-kong ka long ka lynglun bah jong ka pneid pneid ba khluid (hot gas) kaba pra bad kaba kynriah sha jngai na ka Sngi (Parent Sun). Ka Pyrthei katba ka nang rotate ha la u axis bad katba ka nang revolve jngai na ka Sngi ka nang *khriat suki suki* (cool) haduh ba kaba habar ne ka surface jong ka ka kylla khriat bad kaba shapoh la ka shit haduh mynta, ka ruh ka nang khriat suki pa suki.

Ka Pyrthei ha kaba mynnyngkong ruh ka jlih hynrei katba ka nang khriat ka *nangran ne ka nangsti* (contrac-

ted) bad ka *nang khamrit* ruh ban ia kaba ka long mynshwa.

Nalor kata katba ka nangkhriat don ki bynta *kiba kylla ban long eh* kum ka khyndew bad ki maw bad kiwei pat *ki kylla um*.

Dei na *ka jingkhriat suki bad na ka jingran jong ka ba* ka sla ne surface jong ka kam jlih shuh, hynrei ka long phongtung phongteng, kata, don ha ka ki jaka kiba long madan bad them, don ruh kiba long lum; syriem kumba lada shet pynthnam ia u sohphoh nongkhlaw khlem siah ia ka snep bad ynda la sei bad buh halor haduh ba un da khriat bha, yn shem ba un ym jlih shuh hynrei yn don ha u ki bynta kiba at bad kiba them.

Ka Pyrthei ka *rben* lane *ka jylliew* kumba 4000 mile haduh ka pdeng ne ka centre jong ka, bad ia ka bynta kaba habar jong ka kaba kylla ban long eh (hardened) ki khot ka CRUST; kane ka rben ne jylliew kumba 30 mile bad ka kynthup ia ka sla khyndew ha kaba nei shong bad ia ka trai ka duriaw. Ka bynta baroh jong ka khyndew (solid curst) ka long mynshwa eh hapoh ka um bad hadien hadien ka sa at bad sa paw kham sha jrong ia ka sla ka khyndew. Ia ka Crust la pynlong na ki kynja met khyndew (minerals) kiba ki khot ki *Rocks*. Ka klien rocks ha ka Geography ka kynthup ia u shyiap, ka dewbyrtha, ki mawjem, mawshun bad ki maw eh ne ki mawsiang.

Ki *Rock* ki hap ha ki lai jaid ba kongsan:—

1. *Unstratified ne Igneous*. La pynlong ia kine na ka jingtrei ka jingshit. Katba ka Pyrthei ka khriat na ka jingshit banyngkong don ki bynta kiba kylla ban long ki rock kiba eh bad kiba i lam phyrnai; don ruh kiba kum kine ki rock kiba ki Volcano ki kynting shabar. La khot ia ki— (1) *unstratified* namar ba kim don snur ne syrtap. (2) *igneous* namar ba la pynlong ia ki na ka jingtrei ka ding ne ka jingshit.

*U Granite, Lava*, bad ki *Trap Rocks* (ne ki mawsiang

ba long kyrdon kyrdon) kiba ha Deccan ki long na kane ka jaid.

Ki Igneous rock ki long kiba rim tam na ki jaid rock baroh.

2. *Stratified lane Sedimentary lane Aqueous.* La pynlong ia kine na ka jingtrei ka um. Ka um katba ka nang tuid ka rong artad ia u shyiap, ia ka ktieh bad ia kiwei kiwei ki kynja mineral, ka lum ia ki ha ki jaka them lane rud duriaw. Kine ki iaban synrap bad ynda slem da slem ba ki khia ki kylla maw eh. Don na kiba kum kine ki rock ki bapaw haduh ka sla ka khyndew, kata ka pyni ba ia kiba kum kita ki jaka la ki long nyngkong ha ki jaka them, kata hapoh um, hynrei hadien hadien da ka jingtrei kiwei pat ki bor (kum u Volcano, u Jumai etc.) la pynmih ia ki shabar. La khot ia ki (1) *stratified* namar ba ki ialong syrta, (2) *sedimentary* namar ba la pynlong na ka kynja dewktieh. (3) *aqueous* namar ba la pynlong na ka jingtrei ka um. Ki rock kiba hap ha kane ka jaid ki long: (1) *Sand stone lane Sand rock*, (2) *Shale lane Clay rock* (3) *Coal* (4) *Salt rock* (5) u *Limestone*, u *Chalk*, ki *Coral* (kiba la pynlong na ki met ki kynja mrad duriaw) bad (6) *Fossil* kiba long ki maw ha kiba don ka dur ki tyrkhang, ki mrad bad kiwei kiwei ki kynja dieng kiba shah ban ha ki syrta jong ki. Ia ka bynta ba kham bun jong ka Crust ka Pyrthei la pynlong na kiba kum kine ki rock.

(3) *Metamorphic lane ki Rock* kiba la pynkylla ia ka jinglong jong ki. Don ki rock kiba ha ka banyngkong ki long sedimentary lane igneous hynrei da ka bor ka jingshit ne da ka jingiaban la pynkylla ia ki ban long kum ki stratified rock tang ba ki phyrnai kum ki unstratified rock. Kiba hap ha kane ka jaid ki long :—(1) U Marble ne u kynja Limestone baphyrnai (2) U Quartzite ne u Sandstone baphyrnai, (3) Ka Slate ne ka Shale kaba eh bad (4) u Gneiss uba kylla na u Granite; u Gneiss rock u kham don ha ki Himalaya bad Southern India.

Aiu don shapoh ka Crust ym lah ban tip janai, hynrei

ba ki jaka hapoh jong ka ki long ki bashit bad ki bakhluud shibun lah ban thikna na ki *Pung* (wells), ki *Par* (mines), ki *Umshit* (Hot springs) bad ki *Volcano*. Ha ki *Pung* (wells) ki bajylliew da ki spah feet la shem ba ki um ha tynrai ki syaid bha. Ki *Par* (mines) pat katba nang tih jylliew ia ki katta ka jingshit ka nangjur bad ki ong ba ka ksiar ne kino kino ki nar eh kin um lada yn leit rah sha ka jingjylliew kaba 30 mile. Ki *Hot springs* bad ki *Volcano* ruh ki pyni ia kajuh ka jingshisha.

Ia ka bynta ba ha bar ka *Crust* ki khot ka *Soil*. Ha ka ki mih ki phlang bad kiwei kiwei ki jingthung kiba ai jingbam ne kyrshan ia ngi ki briew. La pynlong ia ka na ki maw bad ki rock kiba ni kiba iakhleh bad ki jingthung ba la pyut lem bad ki met ki mrad ba iap. Ka *Soil* ka stang bha ha ki jaka lum ba u sait u slap bad ka rben ha ki jaka madan bad jaka them

Hapoh ka soil don kawei pat ka syrtap kaba kham rben kaba ki khot *Sub-soil*. Ka tynrai ki dieng ka snoh ha ka.

Hapoh ka sub-soil don ki *Rock*. Kita ki rock da ka jingtrei u slap, u thah bad kiwei ki bor ki pdang bad ki pait bad ki kyrsoi ia u shyiap ne ia ka khyndew ba ni shaneng shaduh ka sub-soil bad ka soil kumta la ithuh ia ka jinglong jong ki na ka soil, kata, lada ka soil ka long ka dew mawshun ne dew chalk kata ka pyni ba ka sub-soil bad ki rock kiba hapoh ki long mawshun ne chalk.

Ia u *Limestone*, u *Chalk* bad ki *Coral* la pynlong na ki snep bad ki shyieng jong ki dohkha, ki khñiang bad ki mrad duriaw. Ia u *Dewiong* la pynlong na ki dieng kiba ynda slem da slem ki khylllem ha khyndew bad hadien hadien da ka jingtrei ka um, u jumai bad kiwei kiwei ki bor la ban bad la tap ia ki da ki rock te ki sa kylla dëwiong.

Bunsien ju shem ba ha ki *District* ri lum kiba don ki rock mawshun ba ka um slap haba ka ngam ha khyndew ka bam ia kiba kum kita ki jaka bad ka pynlong ia ki *Krem* ne ki *Pubon* kiba ki khot *Cave* ne *Cavern*. Ha kita ki *Pubon* ka umshun barben ka jaw na sha khlieh bad ka pynlong ia ki lynglun maw baphyrnai kiba lang bad ba



sdien hajrong ne ha sad, ia kita ki khot *Stalactites*; don ruh ki bynta um shun kiba jaw ha tbian kiba ynda ki lang ki lang ki at bad ki pynlong ha madan ia ki lynglun maw ba-phyrnai, ia kita pat ki khot *Stalagmites*. Haba dei badei ki *Stalagmites* ki iasoh bad ki *Stalactites* bad ki pynlong ki Paia maw.

*Ki Daw kiba pynlong ia ka jingkhohruh khohram ka Crust ne ka Sla ka pyrthei ki long:—*

*I. Na ka jingtrei ki Bor kiba nabar*, kata na ka jingbam khyndiat pa khyndiat ia ka khyndew da u slap, u thah, ka ior, ka lyer, etc.

*II. Na ka jingtrei ki Bor kiba napoh khyndew*, kata na ka jingshit suki bad ka jingran ka Pyrthei kaba paw na ka jingtrei ki Volcano, ki Earthquake bad ki Umshit.

Ia ka jingkhohruh khohram ka Sla ka pyrthei ki khot *The relief of the Earth*. Don ki khyndew haduh mynta kiba nang them bad don pat kiba nang kiew ne nang at. Ka Coast ka Norway ka nang at katba ka West Coast ka Greenland bad S. E. England ki nang hiar nanghiar katba ithuh na ki tynrai ki dieng bad ki jingtei kiba paw ha ka por low tide.

*I. Ka jingtrei ki Bor kiba nabar. Ia ka jingpyntwa khyndiat pa khyndiat ia ka khyndew la khot Denudation*. Ki Bor kiba trei ia kane ki long ka lyer, ka jingkylla ka jingshit bad jingkhriat, u thah (frost), u slap, ki wah, ki jingatphyllung (waves), ki tide bad ki jingshad tawiar ki um ka duriaw (currents): *ka jinglong ki jaka* ne ka *Scenery* ka shong ha ka kine ki Bor. Kaba kongsan na kine ki Bor ba nabar ka long ka jingtrei ka Um.

*Ka jingtrei ka lyer*—Ka lyer ka rah ia ki symboh shyiap bad ki mawrit bad ka pyntakhuh ia ki ha ki mawsiang ba jrong, ha kata ka rukom ki mawsiang ki twa khyndiat pa khyndiat. Ka lyer ka rong ruh ia u shyiap na ki ri shyiap bad ki rud duriaw bad ka pynlang ha kiwei pat ki jaka ba kin long kum ki lum shyiap (Sand Hill ne

Dunes), kum ki Landes ha France bad ha ki jaka ha ki rud duriaw ka Belguim; kumta bun ki jaka ba seisoh ki kylla long noh ki ri shyiap.

*Ka jingtrei jong ka jingkylla ka jingshit bad ka jing-khriat*:—Ka jingiapli ka jingshit mynsngi bad ka jing-khriat suki mynmiet ka don bor ban pynpra bad pynpait suki ia ki rock.

(Ia ka Bor pyntwa ia ka khyndew da ka lyer bad da ka jingshit jingkhriat ki khot *Weathering*).

*Ka jingtrei u thah*—Ka um kaba ngam ha ki thliew ki rock ka kylla thah, bad namar ba u thah u shim jaka kham bun ban ia ka um namarkata ki rock ki pdang bad ki pait, bad ia ki shyiap ne ki khyndew ba ni na ki la kit da u slap bad ka lyer sha kiwei pat ki jaka.

*Ka jingtrei u slap*—U slap u pynsumor ia ka soil bad u kit ia ki khyndew ni na ki jaka ba at sha kiba them, bad haba u ngam ruh shapoh khyndew u pynpait bad pynpra ia ki rock bad u pynlong ia ki umpohliw bad ki pubon; nalar kata u kit sha ki river ia ka jakhlia ne ka sbob ba kham ni kaba ki khot *silt*.

*Ka jingtrei ki river*—Ki wah ki pynkylla ia ka Sla ka khyndew ha ki ar rukom:—

1. Da kaba ki pyntwa mian pa mian ia ki jaka lum; bad haba ki trei kumta la ong ia ki river ba ki long ki *Denuding agents*.

2. Da kaba ki kit ruh ia ka khyndew sha ki jaka them bad ki pynlong ia ki Valley bad ki Plain. Ia ki pyntha ba la pynlong ha kata ka rukom ki khot *Alluvial* ne *Flood Plain*. Nalar kata ki wah ki kit ia ka silt sha kiwei pat ki wah bah bad ki duriaw bad ki pynlong ia ki jaka ha ki ba kin jyndong (Shallows), lane ki thaw ia ki jaka shyiap harud ki wah bad ki duriaw (Sand banks) lane ki khang ia ki jaka ha ki mouth ki river (Bars). Haba ki river ki kit kumne ia ka khyndew bad ka silt la ong ba ki long ki *Depositing agents*.

*Ka jingtrei ki wah thah (Glacier)*—Ki wah thah kiba tuid na ki jaka lum kiba ha ki ri kiba khriat ki pynlong thliw ha ki krung ki Lum bad ki pynpait ia ki rock.

*Ka jingtrei ka duriaw*—Ki jingat phyllung, ki jing-iaid tawiar ka um bad ki tide ki bam ia ka rud duriaw bad ki pynlong ia ki Gulf, ki Bay bad ki Cape.

(Ia ka jingbam pyntwa ia ka khyndew da u slap, u thah, ki wah bad ki duriaw ki khot Erosion).

II. *Ka jingtrei ki Bor kiba napoh khyndew, kata ki Volcano, Earthquake, Geyser bad Spring.*

*U Volcano* u long ka jingpdang baheh ne ka thliw bah kaba pei na ka Crust kaba long maw (rocky crust). Kane ka thliw ka long kum ka tyndong bah kaba pyniasoh ia kaba hapoh bad kaba habar ka Pyrthei, bad na ka mih ka tdem, ka dlng, ka dpei, ka khyndew khluid bad ki maw bah kiba jem bad kiba khluid kiba ki khot *liquid Rock* ne *lava*. Ia ka shyntur u Volcano kaba pyllun na kaba ka mih ka lava bad kiwei pat ki kynja bakhluuid ki khot *Crater*.

*Kunno la pynlong ia u Volcano?* Ka bynta kaba hapoh eh ka khyndew ka long ka bashit shibun. Haba ka um, kaba na ka trai duriaw ne na trai ki pung bad ki wah ne kaba ngam na khyndew ba hap u slap, ka pei lyngba ia ki rock kiba ha trai ka Crust, kata ka um haba ka poi sha kita ki jaka bashit ka khluid bad ka thnam, bad namar ba *ka Bor ne Pressure* jong ka tdem thnam (steam) ka kham khlain ban ia ka *Bor ka Pressure* ki rock kiba kah ia ka, namarkata ka kyndat kynsan bad ka khlei bluit ia ka lava bad kiwei kiwei, syriem kumba ka steam, haba ka thnam ka um ha u ketli, ka kyndat ia ka jingtap namar ba khlain ka bor jong ka ban ia ka jong kata ka jingtap.

Haba u Volcano u sangeh, kata um bthei, ka thliw kaba ha ka Crater ka dam.

*Ki Volcano ki hap ha ki lai jaid ba kongsan:—*

1. Active—ki long ki Volcano kiba la bthei bad kiba lah ban iai bthei.

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2. *Dormant*—Ki long ki Volcano ki bym pat ju bthei mynno mynno hynrei kiba lah ban bthei ha kano kano ka por.

3. *Extinct*—Ki long ki Volcano kiba la bthei mynshuwa tang ba ki bried kim shym tip lane iohi ia kata. Ki khyn-dew kiba ha ki Auvergne Mountains ha France, ha ka Deccan bad ha kiwei kiwei ki jaka lum ha India ki pyni ba mynhyndai eh la bthei Volcano ha ki.

*Ki Volcano ki kham don ha ki jaka ba kham jan ia ka duriaw.*

Ki line bakongsan jong ki ha ka Pyrthei ki long:—

1. Ka line kaba ha ki rud ka Pacific Ocean baroh ar liang. Kane ka mih na Cape Horn ha S. America, ka iaid shatei narud duriaw sha ki Andes shaduh Alaska ha N America, nangte ka ryngkang sha ki Aleutian Islands, Kamchatka, Japan bad Philippines, hangne ka pait ar line, kawei ka wan shaphang sepngi sha Indian Ocean bad kawei pat sha mihngi sha New Guinea bad New Zealand shaduh u Mt. Erebus ha Antarctic Continent.

2. Ka line kaba ha ki rud phang mihngi ka Atlantic Ocean. Kane ka mih najan Mayen Island kaba ha Arctic Ocean, ka iaid sha Iceland, N. Scotland, Ireland, Azores, Cape Verde Islands haduh Gulf of Guinea ha Africa, Kane ka line ka don artylli ki tnat kawei ka iaid sha sepngi sha West Indies bad kawei pat sha ka rud ba shatei ka Mediterranean, sha Sicily, Italy shaduh Caucasus.

Ki don kumba 300 tam ki *Active Volcano* ha ka Pyr-thei, bad 200 tam na ki ki don harud ki Pacific bad Indian Ocean. Ha ki Andaman don u Volcano uba ieng marwei uba ki khot *Barren Island*.

*Ki Volcano ki pynlong kumno ia ka Sla ka Khyndew:—*

1. Ki pynmih ia ki Hills bathymmai bad ki Island bathymmai ki paw ha duriaw.

2. Ki kynting ha badei badei ia ki mawbah bad ki bred sha jngai.

3. Ki pynjot ia ki shnong bad ia ki pyntha bah bad bunsien bun hajar ki brierw ki iap hapdeng khyndiat minit.

4. Ha badei badei ruh ki paw kiei kiei kiba phylla na ki Volcano. U Volcano uba la bthei ha 1883 ha Krakota Island kaba ha Strait of Sunda hapdeng Sumatra bad Java u kynting ia ka dewkhluid sha jrong eh sha suin bad la rong ia ka da ki lyer kylleng sawdong bad bun bnai ki brierw na ki dong ka pyrthei baroh ki iohi ba ka saw ka suin bneng ha ki por janmiet na kata ka dewkhluid.

*Ka jingpynkylla dur ki Volcano ia ka India.*—Myn-shwa eh ka Deccan naduh ki Aravalli Hills bad ki Vindhya Mountains ka long ka Plain bad ka iasoh bad ka South Africa, katba ki jaka ha kiba don ki Himalaya bad ka Indo-Gangetic Plain bad shi bynta na ka Burma ki long baroh hapoh duriaw. Ha kata ka por la pyniasoh ia ka Deccan bad ka Continent Asia da i ryndang khyndew lyngba ka Bengal bad Assam Ka Arabian Sea pat ka long ka duriaw ba la ker kut da ka khyndew, ka da iar shaduh Assam bad Tibet. Hadien da ka jingtrei ki Volcano la pynlong ia ka Deccan ba kan long ka Plateau, la kynting ia ka khyndew ba kan ieng sha jrong bad haba kumta la pynlong ia ki Lumbah Himalaya; bad ka Plain of Northern India ka paw halor ka sla ka duriaw, katba ka bynta pat hapdeng ka Deccan bad South Africa ka nang ngam shapoh duriaw.

Ki *Earthquake* ne ki *Jumai* ki long ki jingkhieh ne ki jingkhynñiuh ba kysan ka Sla ka khyndew kiba wan ryngkat bad ka jingriew khru khru na shapoh khyndew.

*Don lai tylli ki daw ba kongsan kiba pynlong ia u Jumai:—*

1. Don ki jaka kiba hapoh ka Crust ka khyndew kiba khriat suki bad kiba ran ne kiba sti (contracted); haba kumta ka syrtap ba ha jrong ka pdang bad ka khieh, nangta ka sa khynñiuh ka khyndew.

2. Don pat ki jaka shapoh ka Crust kiba long thliw haba ka syrtap ba najrong ka ngam sha ki namar ba ka khia, ka khyndew ka khynñiuh.

3. Don ruh ki jaka ha kiba ka um na ka Sla khyndew ka leit ngam bad ka poi sha ki jaka bakhluid kiba shapoh ka khyndew; hangta ka kylla um thnam bad haba ka *steam* ka kynshait shaneng, la kam lah ban pei lyngba (kum ki volcano) ba khlain ki rock kiba kah ia ka, hynrei ka pynkhyññih jur ia ka Sla khyndew kaba haneng jong ka.

Ki *Jingkhiih Jumai* ki hap ha ki ar bynta:—

1. Ki Jumai kiba khiih beit napoh sha jrong (vertical movement). Kine ki jia tang shi lynnong bad ki jaka ha kiba ki khiih haba dei badei ki ngam shapoh (depressed) ne ki at (elevated); ka jingjulor ruh kam da jur eh.

2. Ki jumai kiba khyññih na kawei ka dong bad ki iaiaid sha kawei pat ka dong (horizontal movement). Kine ki iaiaid bun mile bad ha ka jingtrei jong ki, ki jaka ki kylla at ne them bad sniew dur; ka jingjulor ruh ka khraw shi-bun.

Ki *Jumai ki kham don hajun bad ha ki jaka ba don ki Volcano*. Ki line bakongsan jong ki ki long:—

1. Na Azores sha Mediterranean, Asia Minor bad lyngba ka pdeng ka Asia shaduh Japan, bad 2. Ha ki jaka ki Andes ha America.

*Ka mih aiu na ki Jumai?* Ki Jumai ki pynsniew dur ia ka Sla ka Pyrthei; don bun ki jaka kiba twa bad kiba ngam, ki shnong ki jot, ki ing ki kyllon bad bunsien bun spah ki briew ki iap bad kiba im ruh ki jynjar. Kham-tam haba ki Jumai ki khiih ha ki jaka rud duriaw ka jingjulor ka long ka bakhrav.

Ki *Seismograph* bad ki *Seismometer* ki long ki tiar na kiba lah ban ithuh ia ka jingkhiih ki Jumai bad ban thew ia ka bor kita ki jingkyññih. Na kine ki tiar lah ban tip ha kino ki jaka kiba jngai da ki spah mile u khyññih u Jumai wad lada ym don Jumai ha kata ka jaka ha kaba don kita ki tiar.

*Geysers* ki long ki Umkhluid ne ki Hot Springs kiba bthei bad kynshait ia ka um khluid bad ka *steam* sha jrong na ka Sla ka khyndew. Iceland ki khot ia ki *Gushers* (ki nongkynshait) ne Roarers (kiba kyrhuh).

*Kumno la pynlong ia ki ?* Don ki jaka ha kiba ki um na ka Sla ka khyndew ki tuid na ki jingpdang na ki thliew ki ba jylliew sha ki Rock lane sha ki Pung ki bakhluud kiba don shapoh khyndew. Haba ka long kumta ki um khluid ki kynshait shajrong ka Sla ka khyndew haduh 100 ne 200 ft. Ki *Geysers* ki don barobor hajan ki Volcano. Kham shem ia ki ha kine ki jaka:—

1. Ha Iceland hajan u Mount Heckla ki don kumba 100 tylli; ka Great Geyser kaba don hangta ka kynshait haduh 100 ft. shajrong bad ka heh 10 ft.

2. Ha ka Yellowstone Park ha ki Rocky Mountains ha United States hajan ka Missouri Basin don ka Geyser ba pawnam kaba ki khot “The Old faithful” namar ka kynshait um khluid man ka kynta.

3. Ha ka North Island kaba ha New Zealand.

Ki *Spring* ne ki *Umpohliw*—1. Haba ka um slap ka pei lyngba ia ki rock kiba ka lah ban sam lyngba (permeable), kum u shyiap ne ki mawria, bad haba ka nongrim kaba hapoh kita ki rock ka long da ki rock kiba kata ka um kam lah sam lyngba (impermeable) kum u Granite, Clay, etc, te ka um ka kyrsoi bad ka mih Umpohliw na ka krung kaba ha kita ki rock baroh arjaid. Lada tih na jrong ka sla khyndew ha kiba kum kita ki jaka haduh ban da poi ha ka dew sngem kata ka um kan kiew bad kan long Pung (Well). Ia kaba kum kita ki khot *Spring* ne *Surface Spring*.

2. Haba ka syrtap hapdeng kita ki arjaid ki rock (permeable bad impermeable) ka sharing, ka Umpohliw kaba mih na kum kita ki jaka ka mih ha ka por liur bad ka jah myntlang. Kum ia kita ki um ki khot *Intermittent Spring*.

3. Haba dei badei u rock uba ka um ka lah ban sam lyngba (permeable) u don hagdeng artylli ki rock kiba ka um kam lah sam lyngba (impermeable) : kum ha kita ki jaka ki briew ki sam thliw na uta u rock eh uba najrong bad ki sa mih ha ka sla ka khyndew ki Umpohliw ne ki Pung kiba ki khot *Artesian Well*. Ha Baluchistan ki bun kum kita ki Well.

4. Haba ki Umpohliw ki kyrsoi naduh ki jaka ba-khluid kiba shapoh ka khyndew ki um jong ka ki shit bad la khot ia ki *Thermal ne Hot Spring*. Ki Hot Spring ki don bun ha New Zealand. Ki briew ha kita ki jaka ki shong shnong harud jong ki bad ki shet jingbam na kita ki umkhluid. Ha Khasi bad Jaintia Hills ruh don ki umshit, tang ba kim da khluid eh.

5. Ia ki Umpohliw kiba mih na ki jaka kiba don ki khyndew shun ne nar ne mluh etc., ki khot *Mineral Spring*. Kine ki don ka bor dawai ha ki. Ha Bath, Harrogate, Cheltenham, etc., ha England don ki Mineral Spring.

*Delta*—Ki river kiba tuid suki bad kiba kit artad ia ka *sediment* kum ka ktieh, ka khyndew, etc., ynda ki poi ha ki duriaw ki bym jur ki tide ki lum bad ki kynton ha la ka *mouth* ia kata ka sediment kaba suki pa suki ka kiew haneng ka sla ka khyndew bad hadien ynda ka la jrong ka khang ia ka lynti kata ka river ; ynda ki um ki wan tuid pat kata ka river ka wan prat ia la ka lynti ban poi sha duriaw da ki bun ki tnat lyngba kata ka khyndew ba la kynton, bad ka dur kata ka dew kynton ba la phuid da ki tnat kata ka river ka kham long laidong. La khot ia ka Delta namar ka ia syriem ia u *Delta*, u dak ha ka Greek Alphabet.

Ki khein ia ka khlieh ka Delta naduh ka jaka ba ka river ka iashem ha ka ba nyngkong eh bad ka duriaw ; ka Ganges ha ka banyngkong eh ka iashem bad ki duriaw ha ka jaka kaba jngai 220 mile na duriaw. Ki river kiba don Delta ki don bun, kum ka Nile, Po, Rhone, Rhine, Mississippi, Ganges, etc. Bun na ki river ka India kiba don Delta.



Ki river kiba ka lat-lat (current) jong ki ka jur kum ka Congo, Amazon, etc., kim don Delta, hynrei ki bred ia ka sediment sha duriaw shaduh jngai bah na ki mouth jong ki.

Kham bun na ki River ki don *lai tylli* ki *kyrdan* ne ki *stages* ha la ka lynti;—

1. *Mountain stage*.—Ka river haba ka dang mih na ki lum ka tuid stet bad ka bam ia ki rock. Ha kiba kum kita ki jaka ym lah ban leit da ki lieng bad ki jhad (not navigable).

2. *Plain stage*.—Ka river ynda ka poi ha ri thor ka tuid jem bad ka bred katto katne ka sediment ha la ki rud. Ha kiba kum kita ki jaka bit ban leit da ki lieng bad ki jhad (navigable) bad ruh ban ring um sha kiwei pat ki jaka (irrigation).

3. *Delta stage*.—Ka river ynda ka la poi ha khmut duriaw ka ia id kham suki bad ka kynton ia ka sediment ha la ka mouth.

Ia ki jaka ne area ba la ai um da ka river ki khot *Basin* ne *River Basin*.

Ia ki jaka lum kiba don hapdeng ki river-basin ki khot *Water-Parting*, bad la ka sharing kita ki lum kaba ki wah ki tuid arsut ki khot *Watershed*.

Ia ki jaka madan ne ki pyntha ba harud ki river ki khot *Valley*

Ia baroh ki River kiba hap ha ka Ocean la ki hap beit lane ki hap nyngkong ha ki Lake ne ki Sea kiba iasoh bad kata ka Ocean, la ong ba ki pynlong ia ka River System jong kata ka Ocean.

Ia ki Lumbah kiba ia bteng ter ne kiba i kumba ki pait pnat na uwei u Lum uba jrong uba long ka pdeng jong ki, la ong ba ki pynlong ia ka Mountain System jong kata ka jaka.

*Ki Islands.* Ki Island ki hap ha ki arjaid:—

1. *Continental Islands*, kata ki Island kiba don ha ki continental shelf. Ka *continental shelf* ka long ka khyndew hajan ki Continent kaba don hapoh duriaw; ka um ha kata ka *shelf* ka jyndong, kam jylliew palat ia ka 600 ft., hynrei sha lyndet jong ka ka jylliew shibun.

2. *Oceanic Islands*, kata ki Islands kiba don hapdeng ki Duriaw bah bad ki bym iasoh ei ei bad ki Continent. La pynlong ia ki da ka jingtrei ki Volcano ne ki khñiang Coral.

Ki Duriaw bajyndong, kata ki Shallow Seas kiba don ha ki Continental shelf, ki long ki jaka tong dohkha ki babha, namar bun ki dohkha ki ialang ha ki. Ha kiba kum kita ki duriaw ruh ka khaii pateng ka iaid bha namar ba ki tide ki jur bad ki iarap ia ki jhad khaii ban mih bad poi suki ha ki Port.

Ki *Coral Islands* ki long ki dewlynnong, ki bym da jngai na ki Continent, kiba la pynlong da ki kynja khñiang duriaw kiba la khot *Coral Polyp*. Kine ki khñiang ki bam ia ki kynja shun kaba don ha ki um duriaw (kata kaba wallam ki river) bad kata ka pyneh ia ki met jong ki. Ynda ki iap, ki met jong ki ki ngam sha trai duriaw. Kawei pat ka kynhun ki Polyp kiba im ka wan thaw jaka halor kita ki met ki baiap. Ynda kata ka kynhun pat ka iap ki wan sa kiwei pat bad kumta ki met iap kita ki khñiang ki iai kiew ter shi ter ha ban da poi ha sla um bad ki sa long dewlynnong. Da ka bor ki jingatphyllung ia kita ki dewlynnong la pynpait ba kin long dew shyiap. Ki sim duriaw, ki jingatphyllung bad ki jingkhih ka duriaw ki wan buh ha ki ia ki symbai bad bun jaid ki jingthung, bad hadien hadien kita ki Island ki kylla long ri sei-soh bad ki briew ki sa wan shong ha ki.

Ki *Polyp* kim lah im ha sla duriaw, bad hapoh duriaw ruh kim lah im palat ia ka jingjylliew 100 feet, ki im ruh tang ha ki um ki basyiad; namar kata ki *Coral Islands*

ne ki *Coral Reefs* (ne *Rocks*) ki don tang ha ka *Torrid Zone*, kum ki *Laccadive*, *Maldiv*e, *Andaman*, *Nicobar*, *Mauritius*, *Formosa*, *Cuba*, *Bahamas* bad ki *Island* ha *N.E. Australia*.

Ki *Coral Reefs* ki hap ha ki lai jaid:—

1. *Fringing Reefs*, kiba long ki *Coral Island* kiba iasoh ter mar khap ia ka rud duriaw.

2. *Barrier Reefs*, kiba long ki *Coral Island* kiba don ter kham jngai na ka rud duriaw; la ai kyrteng ia ki kumta namar ba ki kah bad ki khang ia ka lynti jong ki jhad.

Ki *Great Barrier Reef* ha *N. E. Australia* ki jngai ha pdeng shiphew bad shi spah mile na ka rud duriaw bad ka lynter jong ki ka long palat ia ka shi hajar arspah mile.

3. *Atolls*, kiba long ki *Coral Island* kiba ker sawdong ia ki *Lagoon* lane ki pung bajyndon kiba harud duriaw bad kiba ki um jong ki ki jyrngam.

*Ki Lake*. Lah ban bynta ia ki *Lake* ha ki ar bynta:—  
ki *Mountain Lake* bad ki *Lake* ha ki *Plain*.

Ki *Lake* ki don saw jaid:—

1. Ki *Lake* kiba ioh la ki um na ki river bad kiba na ki ruh mih kiwei pat ki river.

2. Ki *Lake* kiba ioh la ki um na ki river hynrei ki bym don river kiba mih na ki.

3. Ki *Lake* ki bym ioh um na ki river hynrei kiba don ki river kiba mih na ki.

4. Ki *Lake* ki bym ioh um na ki river bad ki bym don river ruh kiba mih na ki.

*Kummo la pynlong ia ki Lake*:—

1. Don ki *Lake* ba la pynlong na ki jingat ne jing-kiew ka trai ka duriaw bad haba kumta ki jaka ba kham jyndon ki kylla long ryngkew bad ki jaka ba kham jyl-liew ki kylla *Lake*. Ha ka banyngkong eh ki jaka kiba ha-

pdeng ka Black Sea bad Arctic Ocean ki long hapoh duriaw, ynda hadien ki at ne ki kiew bad ki kylla ryngkew, bad sha kita ki thain don mynta bun ki jaka bajylliew kiba long ki Lake, bad ki um jong ki ki long kiba don mluh namar ki long ki um duriaw ha ka banyngkong, kum ka Caspian Sea, Sea of Aral, etc.

2. Don pat ki Lake kiba long ki jaka them hi (natural hollows), bad ia kiba la ai um da ki river, kum ki Lake ha Central Africa.

3. Don ruh ki Lake kiba la pynlong na ka jingiar ka lynti ki wah, kum ki Lake kiba don ha ka River Shannon ha Ireland.

4. Ia ki Mountain Lake la ju pynlong na ki thliew ba ki khlong ki *wah thah* (Glacier) katba ki tuid lyngba.

Ki Lake ki bym don ki river kiba mih na ki ki 'ong barobor kiba *don mluh* (saltish), namar ka bor ka jingshit ki k'jat sngi ka k'jit noh ia ka um sngur na ki kumta sah sa ki um mluh, kum ka Dead Sea, Caspian Sea etc. Ki Lake kiba don ki river kiba hap ha ki bad ruh kiba mih na ki ki long barobor ki *bym don mluh* (fresh), namar haba bun ki um sngur ka bor ki um mluh ka jah noh. Ka Caspian Sea ka long ka Lake kaba khraw tam ha ka pyrt'hei bad ki um jong ka ki long mluh; ka Lake Superior ka long ka Lake kaba khraw tam na ki Lake kiba don um sngur.

*Snow-line* —Haba kiew ia ki Mountain ia kynduh nyngkong ia ki jaka khlaw hadien sa ia ki jaka ba tap da u phlang. khadduh poi ha ki jaka ba tap da ka ior suda baroh shisnem. Ia ka line ha kita ki Mountain kaba pyni ia ka pud naduh ba tap ka ior ki khot *Snow-line*. Ka jingjrong u snow-line kam long katjuh ha ki jaka baroh hynrei ka ia p'her kat kum ki Latitude. Ha ki jaka ki Pole u snow-line u long haduh sla duriaw (sea level), ha ki Alps kiba don ha ki jaka ba kham jngai ia u Equator (kata, ha ki higher latitude) u snow-line u kham hiar sha t'bian haduh 9000 ft. na ka

sea-level bad ha ki Himalaya kiba don ha ki lower latitude kata kham jan ia u Equator, u snow-line u kham kiew haduh 16000 ft. na ka sea-level.

*Ka Glacier*—ka long ka jingialang u thah ba lang (ice river) uba tuid nalar ki jaka ki Mountain kiba shaneng u snow-line sha ki sharing lum bad ki them; ynda uta u thah ba tuid u palat ia ki jaka u snow-line u um bad u tuid kum ka wah.

*Kumno la pynlong ia ka Glacier?* Ha ki jaka halor ki Mountain kiba shaneng u snow-line ka ior ka hap man ka snem, kumta ia ka syrtap kaba hapoh la ban bad la khñiot da ka syrtap kaba ha jrong. Ka Sngi pat ha ka por lyiur ka pynum ia kata ka ior ha ka syrtap ba hajrong bad kata ka um ka ngam sha ka syrtap ba hapoh, kumta kata ka ior ka kylla ban long u thah tylli ba lang. Bad namar ba la ban khia ia uta u thah bad ba don ruh ka bor kaba ring ia u sha ki jaka ba sha thian (force of gravity) kata ka lynglun thah ne ka Glacier ka tuid suki; ynda ka la palat ia u snow-line bad ba ka poi sha ki jaka ba kham shit ka um bad ka tuid kum ka wah, tang ba ki um jong ka ki jakhlia bad long ktieh namar ba ka khlong ia ka khyndew bad ba ka tuid lyngba ia ki jaka ha kiba don ki rock. Ha kata ka rukom don ki river kiba ka tynrai jong ki ka mih na ki Glacier, kum ka Ganges na ki Glacier na ki Himalaya, ka Rhone na ki Glacier na ki Alps.

Ka Glacier ka kham tuid suki ban ia ka river, tang ba haba ka dang don ha khlich bad hapdeng u Mountain ka tuid kham stet ban ia kaba ka la poi ha krung bad ha trai jong u; ka tuid kham stet ruh mynlyiur ban ia myntlang.

Katba ka Glacier ka tuid ka khlong da ka bor u thah ia ki rock bad ki maw bad ka rong ia ki naduh ka jaka ba kan sa kylla um. Ia kita ki rock, ki mawrit bad kiwei pat ki ñiut ba la pynlong bad ba la pynsaphred da ka Glacier ki khot *Moraines*.

*Kumno Ka Glacier ka leh ia ki rock?* Ka jingkhia bad jingkhriat u thah tylli haba u tuid ka pynkhliah ia kiba at bad batam (projections) na ki rock bad kumta ka pynjih

ia ki; ka pynkyllon bad khlong ruh ia ki maw ba kham rit, te ia ki rock kiba hapoh la trud bad pynsniew dur da kita ki maw ba ka rong ka Glacier. Kiba kum kita ki rock ba la trud bad ki maw bapyllon ki don bun ha ki Valley ka Switzerland kiba pyni ba mynshuwa la don hangta ki Glacier, la mynta kim don shuh.

Ki *Iceberg* ne *Ice Mountain* ki long ki lum thah batylli kiba per ha duriaw ba ki dkut na ki Glacier kiba mih bad kiba tuid na ki jaka kiba na shajan ki Pole.

*Kumno la pynlong ia ki?* Ha ki Polar Region ha kiba u snow-line u iaryngkat bad ka sea-level ki Glacier ki tuid sha duriaw shaduh jngai. Da ka jingtrei ki jingatphyl-lung bad ka jingiaid tawiar ki um la pyndkut ia ki, ki sa per ha duriaw kum ki Mountain bad la rong ruh ia ki sha ki jaka ba kham syaid (warmer latitude), hangta ki Iceberg ki um bad ki bred harud duriaw ia ka khyndew bad ki maw ba ki kit. Don ha Newfoundland kiba kum kita ki *Kynton khyndew* ne ki *Banks* ba la pynlong ha kane ka rukom da ki Iceberg.

Ki Iceberg (kiba long kiba khriat) haba ki poi ha ki jaka ba ka lyer ka lam shit (warm) ki pynlong ia ka ba kan thanda syaid (cool), nangta sa mih u *lyoh khyndew* (fog). Bunsien ki jhad ki bakla lynti hapdeng uta u lyoh khyndew uba ha sla duriaw bad ki ia tyngkhuh bad ki Iceberg kiba pynpait bad pynngam ia ki, bad bun ki *abrew* ruh ki iap.

Ki Iceberg ki mih bad ki tuid na shaphang Arctic and Antartic Ocean.

## KA DURIAW.

Ki um ka duriaw ki lam jyrngam bad lada mad ia ki ki kthang mluh. Kane ka long namar:—

1. Ba ka kynja jinghaw bashit (ne hot vapour) na kaba la pynlong ia ka duriaw ha kaba nyngkong eh, ka long hi kaba don mluh.

2. Ba ki river haba ki iai hap ha ka duriaw ki wan rah artad ia ki kynja mineral, khamtam ka mluh, kiba ki kit na ki Rock bad ki Mountain. bad ynda la slem ki um ki kthang mluh.

Hynrei ki don ki duriaw kiba kham kthang mluh ban ia kiwei pat. Ki um kiba ha ki duriaw kiba ha u Torrid Zone ki kham kthang mluh ban ia ki duriaw kiba ha ki Higher Latitude bad kiba ha ki Polar Region. Kane ka long na kine ki daw:—

1. Ka bor ka jingshit ba ki kjit ki kjat sngi (evaporation) ia ki jinghaw um sngur ka kham khlain bad kham jur ha ki Tropic bad kumta ki um hangta ba ki kham rngad ki kham kthang mluh.

2. Ki um sngur kiba wan hap na ki river ki pynduna ia ka jingkthang mluh ka duriaw, syriem kumba lada theh um ha ka jingtah kaba la ber mluh ka jingtah ka blad. Ha ki duriaw kiba ha ki Tropic ym don bun ki wah kiba hap ha ki kumta ka jingpyndap ia ki um sngur ka duna ban ia ka bor ka jingkjit ki kjat sngi. Ha ki duriaw pat kiba don ha ki Higher Latitude ki don bun ki wah kiba hap, kumta ki um jong ki kim da kthang mluh eh.

Dei na kine ar tylli ki daw haneng ba ka Mediterranean Sea ne ka Red Sea ki kham kthang mluh ban ia ka Baltic Sea.

*Ka jingjylliew ka Ocean.*—Ka nongrim ne ka bed ka Ocean kam da jlih bha, ka khohruh khohram tang ba kam da at da them eh kum ki jaka ha ka sla ka khyndew. Ka jingjylliew ka duriaw haba khein average ka long kumba

2½ mile, ka duna kumba ½ mile ia ka jingjrang ki jaka lum ka khyndew, kata kiba jrang kumba 3 mile haba khein average.

La shim te ia ka *sla ka duriaw* ne ka *sea-level* ban long ka *jaka pdeng* na kaba yn thew ia ka jingjrang ki Lum bad ka jingjylliew ka Duriaw.

*Ki jingkhiih bakongsan ka Duriaw* ki long:—

*Ki jingatphyllung* (waves), *ki jingtuid tawiar* ki um na *kawai ka jaka sha kawai pat* (currents) bad ki *tides*.

*Ki Waves*.—La pynlong ia ki Waves na ka jingbeh ki lyer (winds). Haba ki lyer ki beh ha ki *sla ka duriaw* ki pynkhiih bad kynting ia ki um jong ka. Ynda kita ki um ba la pynkhiih ki poi harud duriaw ki tur sha ryngkew, ki pynpait bad pynkylla shyiap ia ki rock kiba harud, ki ban bad pyntwa ia ki jaka maw bajrong, nangta ki wan paw kum ka kynja tyrtho (surf) harud duriaw bad haba jur ka eriong ki kiew shajrong haduh 40 ft. Ki rock kiba harud ki rud duriaw shaphang sepngi ka Ireland bad Scotland ki shah bam ha kane ka rukom, kumta ba ka rud duriaw (ne coast line) jong ki ka long kumba oh tah (broken ne irregular ne indented).

*Ki Current*.—Ki um ka duriaw ki tuid ne ia id tawiar namar :—

1. Ba ka Pyrthei kam neh ha ka juh ka jaka hynrei ka rotate ha la u axis.

2. Ba ki iapher ha ka jingrben jingstang (density). Ki um kiba ha ki Equitorial Region ba ki long kiba kham syaid ki kham sting ia ki um Polar Region bad namar kata ki tuid na *ka sla ka duriaw* (surface current) sha ki jaka ki Pole; katba ki um khriat pat kiba na shaphang ki Pole ba ki kham rben bad kham khia ki tuid kham na *sha poh ka duriaw* (under current) sha ki jaka u Equator.

3. Ba ka bor ka jingkjit ki kjat sngi ia ki um ha ki Equitorial Region ka kham jur bad kumta ki um na ki Pole ki tuid sha ki bad ki pyndap ia ka jaka kita ki um ba la rngad.



4. Ba ka lyer ruh haba ka beh barobor na kawei ka liang ka pyntuid ia ki um na ka sla ka duriaw, kata ka pynlong ia ka *Surface Current* ne *Drift*.

5. Ba don ki khyndew bah kiba at bad kiba them hapdeng ki duriaw.

Namar ba ka Southern Hemisphere ka long ka Water Hemisphere kumta bun na ki Current ki kham mih na ka South Equitorial Region bad Antartic Ocean.

*Ki Current ha ka Atlantic* (kata S. Equitorial Current, Brazilian Current, Gulf Stream Drift, N. Equitorial Current bad Labrador Current). Ki um na ka Antartic Ocean ki tuid shaphang shatei shaduh West Africa bad South America Ynda ki poi ha kita ki thain ki iasoh bad ka *South Equitorial Current*. Kane ka Current ynda ka poi hajan Cape St. Roque sha sepngi na Brazil ha South America ka pait ar bynta, ia kawei ka bynta kaba phai shaphang shathie ki khot *Brazilian Current*, kane ka iasoh pat bad ka Antartic Current; kawei pat ka bynta ka tuid shatei sha Caribbean Sea, ynda ka iaiaid sawdong ia ka Cuba ka rung ha Gulf of Mexico bad namar ba ka rotation ka Pyrthei ka jur ha kita ki jaka kane ka Current ka tuid na Florida Strait shaphang shatei lam mihngi bad ki khot ia ka *The Gulf Stream Drift* Ki um jong ka ki iakhleh bad ka North Equitorial Current bad ki long kiba syaid, ki iar ruh 40 mile. Ynda ka Gulf Stream ka poi kumba shiteng lynti ha ka N. Atlantic Ocean, ha kaba ka iar 800 mile, ka pait ar bynta, kawei ka bynta ka phai shaphang shathie sha Portugal bad N. W. Africa ka sa iasoh pat bad ka N. Equitorial Current ka da lum hapdeng ka lyngwiar jong ka ia ki niut duriaw laiphew jaid; bad ia kiba kum kita ki bynta ka duriaw ha kiba ki um kim da jur eh ka jingkhieh ki khot *Sargasso Sea*. Kawei pat ka tnat ka Gulf Stream, da ka bor ki lyer kiba beh, ka shaphang shatei lam mihngi bad ki um ba syaid jong ka ki pashait ha ki rud duriaw ka British Isles bad Norway ki da pynlong ia kita ki jaka ba *kin syaid* la ki long ha ki higher latitude.

Ka Current ki um khriat kaba tuid na ki duriaw ka Arctic shaphang shathie na Greenland ka iashem bad ka

*Labrador Current* kaba na Baffin's Bay. Shajan Newfoundland shi bynta na ka ka iashem bad ka Gulf Stream ka da kit ia ki Iceberg sha jngai shwa ba kin um ; shi bynta pat ka tuid shathie narud ki rud duriaw ka United States; ia ka line ha kita ki rud duriaw kaba pyniakhlad ia ki um khriat bajyrngam ka Labrador Current na ki um syaid ba lam byrlich jong ka Gulf Stream ki khot *The Cold Wall*. Ki ong ba lada tong na kajuh ka jhad ia ki um jong kita ki Current kin iapher haduh 30° ha ka jingsyaid jingkhriat.

Ka Gulf Stream, namar ba ki um jong ka ki syaid, ka pynkylla ia ka jinglong ka jingshit bad ka jingkhriat ha ki jaka ha kiba ka poi. Ka Coast ka Norway da ka jingtrei ka Gulf Stream kam ju sur thah, katba ka Baltic Sea kaba don ha u lower latitude ban ia ka Norway ka sur thah bun bnai ha ka shisnem. Kumba khyndai bnai na ka shisnem u thah u tap ia ka Labrador kaba don ha ujuh u Latitude bad ka Great Britain, katba ha Great Britain ka pyngngad namar ba ka pynsyaid ka Gulf Stream. Ka North Cape kaba hapoh ka Arctic Circle ka long katjuh ka jingshit jingkhriat bad ka New York kaba long 40° N. Lat.

Hajan Newfoundland ha kaba iasoh ki um khriat ka Labrador Current bad ki um syaid ka Gulf Stream don barobor u lyoh khyndew (fog) namar kita ki um syaid ki kylla khriat.

*Ki Current ha ka Pacific Ocean.*—(kata Peruvian Current, S. Equitorial Current, New S. Wales Current. Equitorial Current, N. Equitorial Current, Kuro Siwa).

Ki um khriat na ka Antarctic ki tuid shaphang shatei narud ka rud duriaw kaba sha sepngi ka South America, kata naduh rud ka country Peru, te la khot ia ka *Peruvian* lane *Humboldt Current*. Ynda kane ka Current ka poi hajan ki jaka u Equator ka phai shaphang sepngi bad ka iasoh bad ka *S. Equitorial Current* ha ka Pacific Ocean shaduh ki Malay Archipelago. Hangne ka pait lai pnat:—

1. Ka tnat kaba tuid shaphang shathie sha Australia kaba ki khot *New S. Wales Current*; kane ka iasoh pat bad ka Antarctic Drift.

2. Ka tnat kaba rung sha Indian Ocean bad kaba iashem bad ki *Equitorial Current*.

3. Ka tnat kaba kham heh ka iasoh bad ka *N. Equitorial Current* hajan Phillippines bad ka tuid shaphang shatei sha ki rud duriaw mihngi ka Japan bad Kamchatka; hangta la khot ia ka *Kuro Siwa* (Black Stream) ne *Japan Current*. Ynda kane ka Current ka iasoh bad ki Current khriat kiba na Sea of Okhotsk bad Behring Sea ka pait pat ar pnat, kawei ka tuid sha Alaska bad N. W. America kawei pat ka iasoh biang bad ka N. Equitorial Current bad ka lum hagdeng ka lyngwair jong ka ia ki niut ki nter duriaw, kata, ka pynlong ia ka *Sargasso Sea*.

Ki um ka Kuro Siwa ki syaid bad kumta ki pynngad bad pynsyaid ia ki jaka ka Japan bad kiba marjan. Kane ka Current ka kham iar ban ia ka Gulf Stream tang ba ka kham iaid suki.

*Ki Current ha ka Indian Ocean.*---(kata West Austlian Current bad Agulhas Current). Ki Current kiba ha ki bynta kiba shatei ka Indian Ocean ki tuid sha ki phang ba ki beh ki monsoon ne ki lyer kit slap. Ha ki bynta kiba shathie, ka Indian Ocean ka Current kaba wan tuid na Antarctic Circle ka iaid nyngkong na West Australia bad la khot ia ka *The West Australian Current*; da ka bor ki lyer la pynphai ia ka shaphang sepngi bad ha Madagascar ka pait ar bynta: kawei ka bynta ka phai biang shathie bad ka iasoh bad ka Antarctic Drift, kawei pat ka tuid na neng Madagascar lyngba ka Mozambique Channel shaphang shathie ia ka rud duriaw ba shaphang sepngi ka Africa. Ki khot ia ka *Agulhas Current* bad ki um syaid jong ka ki sa iasoh pat bad ka Antarctic Current.

*Ka lnti ne ka phang sha kaba ki Current ki tuid ka long:—*

1. Kat kum ki phang ba ki beh ki lyer, kane ka long

khamtam ia ki Current kiba na ka sla duriaw (surface current).

2. Kat kum ka rotation ka Pyrthei. Haba ka Pyrthei ka rotate na West sha East ki um ne ki lyer kiba ha ka sla jong ka ki phai sha kamon ne shaphang mihngi ha ka Northern Hemisphere bad sha kadiang ne shaphang sepngi ha ka Southern Hemisphere.

3. Kat kum ka jingshong ka khyndew ha ka jingat jingthem (configuration of the land). Lada yn ym don khyndew hajan ki jaka u Equator ki Current na ka Antartic Ocean kin tuid shaphang sepngi, hynrei namar ba don ka Africa, East Indies Islands bad South America ki Current ynda ki poi ha ka Equitorial Region ki pyntuid ia ki um syaid jong ki shatei bad shathie shaduh ki Polar Region.

*Ki jingmyntoi kiba ioh na ki Current ki long :—*

1. Ki pynpher ia ka jinglong ki jaka ha ka jingshit bad jingkhriat. Ki Current kiba na ki Equitorial Region ki leit lam ia ki um syaid sha ki ri ba khriat bad kumta ki pynsyaid ia ki, bad mar khongpong pat ki Current na ki Antartic bad Arctic Ocean ki leit lam ia ki um khriat sha ki jaka bashit bad kumta ki pynpynggad ia ki (kumba la batai haneng ia ka jingtrei ka Gulf Stream Drift bad ka Labrador Current).

Hynrei ha ki jaka bad ki ri ba iashem ki Current syaid bad ki Current khriat ki eriong (storm) ki ju khie. kum ki Tornadoes ha United States bad ki Typhoons ha Japan, bad ha duriaw pat mih u lyoh khyndew (Fog).

2. Ki iarap ia ka khaii pateng ha kine ki rukom :—

(a) Ki rud duriaw hajan ki Port ba ki tiud ki Current kim sur thah namar ba ki poi ki um syaid, kumta ki jhad ki lah ban mih bad ban poi ha ki da kaba suk baroh shi snem.

(b) Ki Current ki iarap ia ka jingiaid ki jhad ha duriaw, kata, ki jhad haba ki iaiaid sha ka phang ba ki tuid ki Current (kum ka jhad kaba mih na New York sha Liver-

pool) ki poi kloi : hynrei haba ki iaid pat pyrshah ia ka lynti ki Current (kum ka jhad kaba mih na Liverpool sha New york) ki kham poi bun sngi.

(c) Ki Current ki pynpoi ruh shibun ki dohkha na ki jaka khriat sha ki jaka ba syiad namar ki dohkha ki shong bun ha ki um khriat kumta ki jaka shajan Newfoundland, North Sea bad North of Japan ki long ki jaka tong dohkha ki babha.

Kiba *kham ai jingmyntoi* na ki Current baroh ki long :—Gulf Stream Drift bad Kuro Siwa.

*Ki Current ha ki Sea kiba ker da ka khyndew.* Kine kim iasoh ei ei bad ki Current ki Ocean. Ha Mediterranean bad Red Sea namar ba ka um ka duna ba kjit ki kjat sngi bad ruh namar ba ka um ban pyndap ka duna ba don tang khyndiat ki river kiba hap ha ki, ki Current ha kita ki jaka ki jur bha tang hapoh ka pud jong ki hi; katba ha Baltic Sea, Black Sea, Hudson Bay etc., namar ba ka um pyndap na ki river ka palat ia ka um ba pynduna ki kjat sngi, ki Current la kim da khlain eh hynrei ki tuid wat na ki sha ki duriaw ba marjan.

Ka *Sargasso Sea* ka long ka duriaw ba jai jai ba la kdup da ki Current ha kaba ki ñiut ki ñier duriaw ba ki rong kita ki Current ki ia tuid tawiar sawdong. Don artylli ki *Sargasso Sea* : (1) *Ha ka Atlantic Ocean* shaphang shatei ki West Indies, la kdup ia ka da ka tnat ka Gulf Stream bad ka N. Equitorial Current. (2) *Ha ka Pacific Ocean* sha mihngi na Japan; la kdup ia ka da ka tnat ka Kuro Siwa bad ka N. Equitorial Current.

## KA ATMOSPHERE.

Ia ka syrtap ka suin kaba kham hapoh kaba kdup ia ka lyer ki khot Atmosphere. Ka Atmosphere ka iar bad ka kot haduh kumba 50 mile tam shajrong, don kiba ngeit ba ka kot haduh 200 mile : hynrei lada kiew shaneng palat ia ka 5 mile ym lah ban im namar ka lyer shata ka nang stang bad lada kiew haduh 7 mile yn ym ioh lyer wat tang ban pynhiar mynsiem.

Ia ka lyer la pynlong da kine ki *kynja Jynghaw* lane *Gas*:—*Oxygen* bad *Nitrogen*, bad ruh katto katne na ka *Carbonic Acid*, na ka *Water Vapour* (lane ki symboh um kiba don ha suin) bad na ki *Pui Pui* (*dust particles*) bym lah iohi da ki khmat.

Lada ngi khmih haba ka um ha u ketli ka thnam ngi iohi ia ka jinghaw um (steam) ba ka mih na shyntur jong u bad ynda kata ka jinghaw um ka poi kham sha jngai ngim iohi shuh ia ka. Ia ka rukom ne process da kaba ia ka um ba lah ban iohi (visible) la pynkylla da ka bor ka jingshit ban long jinghaw bym lah ban iohi (invisible) ki khot *Evaporation*.

Lada ngi buh ka tyndong it hajan ka shyntur u ketli ba la thnam khnang ba ka steam kan rung ha u ngin iohi sa shipor ba ki jinglang um ne ki drop ki don hapoh kata ka tyndong it. Ka daw ka long namar ba kita ki jinghaw ba shit ki ia kynduh bad ka bynta ba khriat jong kata ka tyndong. Ia ka rukom ne proceess da kaba ia ka jinghaw ne vapour bym lah iohi (invisible) la pynkylla da ka bor ka jingkhriat ban long um ba lang ba lah ban iohi (visible) ki khot *Condensation*.

Ki kjat Sngi ki *kjit* ne *evaporate* man ka sngi na ki wah bad ki duriaw ia ki um bad ki rong ia ki sha suin, hangta ki kylla ban long ka *gas* kaba ki khot *water vapour*; ki lyer (winds) ki kit bad pynpoi ia kita ki water vapour sha kylleng ki jaka ka suin. Ka water vapour pat ynda ka kiew shajrong ka iasoh bad ki pui pui kiba don ha ka lyer kaba khriat ha ka suin bneng, nangta ka sa kylla *um balang* (ne condensed) ha ki bun ki rukom, kum u lyoh, slap, phria, umjer, lyoh khyndew, thah, ior etc.

Lada rah na ding ia u ketli ba la thnam bad buh ia u harud ngin shem ba hadien katto katne kynta u la khlei ne pynmih noh pat ia kata ka jingshit ba u la ioh bad ba ka um ha u ka la kylla khriat biang. Ia ka rukom ne process da kaba ka met ba shit ka khlei ne pynmih noh ia kata ka jingshit kaba ka la ioh ki khot *Radiation*.

Ki um kiba na ki wah bad ki duriaw bad ka khyndew kumjuh ki khlei ne *radiate* mynmiet ia ka jingshit kaba ki la pdiang mynsngi na ka Sngi.

*Temperature*:—ka ktien '*Temperature*' ka mut ka jing-long ka suin bad ka sla ka khyndew ha ka jingshit jing-khriat ka lyer. Ia ka lyer shit la ong ba ka don ha ka *high temperature* bad ia ka lyer khriat ha ka *low temperature*.

Ia ka temperature ne ia ka jingshit jingkhriat la thew da u tiar uba ki khot *Thermometer* uba long u kynja tyndong it (glass tube) u bym don thliw ha uba ki la thep lpa da ka mercury, kaba long ka kynja um ba lang bad ba rben. Ha u thermometer don arjaid ki kynja it, ha ka bynta ba shaneng ka tube ka it ka kham rben bad la buh dak ha ka da ki degree, ki khot ia kata ka bynta *the stem*; ka bynta kaba sha kjat pat ka long da ka it kaba stang bad ha ka la thep ia ka mercury, ki khot ia kata ka bynta *the bulb*. Ka lyer shit kaba nabar ka rung sha ka bulb lyngba ita i it stang, te ka mercury ka kiew sha ka stem ka da kdew artad ia ka degree ka jingshit; lada ka lyer ba habar ka khriat pat ka mercury ka hiar ha kata ka stem ka da kdew ia ka degree ka jingkhriat. Don lai jaid ki thermometer, hynrei uba ki kham pyndonkam ha England u long u *Fahrenheit* uba la ai kyrteng na u nongshem nyngkong. Ha kjat ka stem jong une u thermometer la buh dak 32° kaba long ka degree ha kaba ka um ka kylla thah, kata haba khriat than eh, bad ha khlieh ka stem pat la buh 212° kaba long ka degree ha kaba ka um ka thnam, kata haba ka khluid than eh; te don 180° ha pdeng. Kumta ha ka jaka kaba long 35° F. ngi sngewthuh ba ka khriat shibun bad ha ka jaka pat kaba long 90° F, ka la kham

shit. (Ki Doktor ruh ki thew ia ka jingshit kaba ha ka met ki briew da u thermometer uba kham rit).

Ka lyer katba nang kiew sha ki jaka lum ka nang kham khriat ban ia ka lyer kaba don ha tbian; kumta ha ki jaka ba kham them ka degree ha u thermometer ka kham kiew ha ki jaka lum pat ka degree ka kham hiar bad ha man la ka 300 ft. kham shajrong na ka sea-level ka temperature ka hiar 1° F. ha u thermometer.

*Ka Jingkhia (Weight ne Pressure) ka Lyer.* La ngim lah ban iohi bad tba ia ka lyer hynrei lah ban thew ia ka jingkhia jong ka. Ka lyer kaba kham shajrong ha ka atmosphere ka sting, hynrei ka lyer kaba don syndah ka sla ka khyndew ka rben bad ka kham khia (1) namar ba ka pyrthei ka ring ia ka bad ruh (2) namar ba ka lyer ba kham hajrong ka ban ne ñiat sha tbian (press) ia ka lyer kaba ha ka syrtap ba hapoh haduh ba kan da poi hajan ka sla ka khyndew.

Lah ban thew ia ka *Jingkhia* ne ka *pressure* ka lyer da u tiar uba ki khot u *Barometer* uba long u kynja tyn-dong it (glass tube) uba pei thliw tang shiliang bad uba jrong kumba lai feet, ha uba la thep ia ka mercury. Lada shim ia ka bol ne ka khuri ha kaba la thep mercury ha ka ruh, bad lada yn pynieng beit ha ka ia kata ka tube mercury na ka liang ba pei thliw te kata ka mercury kaba ha kata ka tube kan kiew haduh 30 inshi palat ia ka level jong ka mercury kaba ha ka khuri. Kata ka pyni haba ka *lynglun* (ne column) ka mercury ha ka tube ka kot 30 inshi ka jingjrong, ba ka ia ryngkat ia ka jingkhia ka *lymbung* (ne column) ka lyer kaba don ha ki kyntoit kiba ha kajuh ka bynta ka atmosphere. Kine artylli ki column (kata ka column ka lyer kaba habar bad ka column ka mercury ka-ba kot 30 inshi ha, ka tube) ki ia long kum ki artylli ki jingsong kiba ia ryngkat ka jingkhia ha ka tarajur. Te haba ka lyer kaba habar ha kano kano ka bynta ka sla ka khyndew ka kham sting namar ba- ka la kiew sha jrong, ka mercury ha ka tube ka hiar, bad haba ia kata ka lyer ba la kiew la shon ne la ñiat biang sha tbian ba kumta ka la khia biang, ka mercury ha ka tube ka kiew pat. Kumta



ka jingkiew ne jinghiar ka mercury ha ka tube ka pyni ia ka jingsting ne jingkhia ka lyer ha ka atmosphere (atmospheric pressure).

Lada yn thew ia ka mercury kaba jrong 30 inshi ha ka tube yn shem ba ka khia lajan 15 lbs. man ka shi square inshi, namar kata la shim lane la khein ruh ba ka jingkhia ne ka pressure ka atmosphere ha ka sla ka khyndew, kaba long ha ka sea-level, ka long 15 lbs. man ka shi square inshi. Ha u Mount Blanc uba jrong 1500 ft. palat ia ka sea-level ka lyer ka kham sting, te ka mercury ha ka tube ka hiar haduh ka degree kaba pyni ba ka khia tang  $7\frac{1}{4}$  lbs. man ka shi square inshi ka jaka.

*Ka jingkiew jinghiar ka mercurry ha tube ka shong:—*

1. Ha ka jingshit jingkhriat ka lyer. Haba ka temperature ka jur ka lyer ka kiew sha jrong, te ka lyer kaba ha sla khyndew ka kham sting (less dense), kata ka mut ba ka atmospheric pressure ka duna bad haba kumta ka mercury ha ka tube ka kham khia bad ka hiar.

2. Ha ka jingbun ne jingduna ka water vapour ha ka lyer. Ka water vapour haba ka iasoh bad ka lyer ka kham sting ban ia ka lyer haba ka tang marwei hi (pure air). Kumta haba shibun ka water vapour ka kiew sha jrong na kano kano ka bynta ka sla ka khyndew ka lyer kaba ha kata ka bynta ka sting bad ka mercury ha ka tube ba ka kham khia ka hiar, bad ka jinghiar u Barometer kum ha kita ki jaka ka pyni ba u slap un sa hap.

Na u Barometer lah ban tip (1) *ia ka jingkhia jingsting (pressure) ka lyer* bad ruh (2) *ia ka jingjrong (height) ki lum na ka sea-level.*

*Kumno yn tip katno ki lum ki jrong na ka sea-level?*  
Man la ha ka jaka kaba jrong 1000 ft. palat ia ka duriaw ka mercury ha u Barometer ka hiar shi inshi. Kumta lada leit rah ia u Barometer ha khlieh u lum bad haba iohi ba ka mercury ka hiar  $18\frac{1}{4}$  inshi (haba khein na ka column jong ka kaba 30 inshi la sngewthuh ba uta u lum u jrong  $3\frac{1}{4} \times 1000 = 18500$  ft. na ka sea-level.

*Balei ba thew ia ka jingkhia (pressure) bad ia ka jingshit jingkhriat (temperature) ka lyer da ka mercury?*

Ka mercury ka long ka kynja um kaba rben bad kaba khia. Lah ban thew da ka um ruh ia ka jingkhia bad jingshit ka lyer, hynrei ka tiar thew ka dei ban long kaba heh shibun eh bad yn wit ruh haba pyndonkam ia ka, kumta ba ka tiar thew kan kham rit bad kham suk ki pyndonkam da ka mercury kaba khia  $13\frac{1}{4}$  shah palat ia ka jingkhia ka um.

*Ki um kiba don ne kiba snoh ha ka Atmosphere (moisture of the Atmosphere)*

1. *Lyoh (Cloud)*. Ia ka vapour kaba kiew na ki wah bad ki duriaw ym lah ban ioi katba ka dang jan ia ka khyndew, hynrei ynda ka la kiew kham shajrong ka iasoh bad ki syrtap lyer khriat lem bad ki pui pui bakhriat, ka sa kylla long ki *lyoh* ne *water dust* kiba per ha suin katba ki dang sting.

2. *Umjer (Dew)*. Mynmiet ka sla ka khyndew ka khlei pat (radiate) ia ka jingshit ba ka la ioh mynsngi na ka Sngi, kata ka lyer shit ynda ka la iashem bad ka syrtap ba kham khriat kaba haneng khyndiat ia ka ka syaid (cooled) bad ka kylla water vapour, bad namar ba ka temperature ka lyer ka hiar ne ka khriat kata ka water vapour ka kylla rben (condensed) bad ka hap mynmiet ha ka khyndew ha ka dur ka umjer. Ia ka degree ha kaba ka water vapour ka kylla umjer la khot *dew point*. Lada ka temperature ka hiar haduh  $32^{\circ}$  F. (kaba ki khot freezing point ne ka jinglong ha kaba ka vapour ka kylla um) te ka umjer ka hap ha khyndew ha ka dur u *thah lieh uba lang* (*white frost* ne *hoar frost*).

*Balei ba ka umjer ka bun ha ki miet bym dan lyoh bad ba ka khyndiat pat ha ki miet ba don lyoh?* Ki lyoh ki khang ia ka jingkhlei ka jingshit (radation) kaba mih na ka sla ka khyndew, kumta ym don bun ka water vapour ha kiba kum kita ki miet : hynrei ha ki miet ki bym don lyoh ka jingpynmih ia ka jingshit na khyndew ka kham bun bad ka water vapour ruh ka bun, te kumta ka umjer ka kham hap.

3. *Fog bad Mist (ki lyoh khyndew)*. Ka sla ka pyrthei ka kham khriat ynda kham miet bad mynstep ynda ka la kham pynmih (radiated) bun ia ka jingshit. Lada don shibun ka water vapour ha ka lyer tang haneng khyndiat ia kata ka sla pyrthei kaba la khriat, kata ka vapour ka kylla um ba lang (condensed) bad la khot ia ka *Fog ne Mist*. U Fog u kham don haneng khyndiat ia ka sla khyndew bad u kham rben ha ki jaka ki wah bad ki sea, kum ha Brahmaputra bad ha ki jaka harud Newfoundland. Ia u fog uba kham bun um, kum uto uba don halor bad ha ki sharing lum ha kiba ka lyer ka kham khriat, ki khot u Mist.

4. *Slap*. U Slap u long ki jingjaw ne ki drop um kiba hap na ki lyoh. Katba ka lyer kaba na sla khyndew ka nangshit, ka nangkiew kham shaneng ka da kit artad ia ka water vapour. Ynda kane ka vapour ka iashem bad ki pui pui lem ki syrtap lyer kiba kham shaneng bad kiba khriat ka kylla um ba lang (condensed) bad ka paw ha ka dur ki lyoh ha la ki kyntoit kyntoit. La pyniashem lang ia kine ki lyoh da ka bor ka jingbeh ki lyer bad haba kumta ki nang kham heh bad kham iong, bad hadien namar ba ki khia bad ba ring artad ka Pyrthei ia ki ki hap sha tbian ha ka dur u slap. Dei haba ka temperature ka lyer ka hiar kham hapoh ia ka *dew point* ba ka water vapour ka lang bad ka sa kylla bad hap ha ka dur u slap. Bunsien ha ki jaka ki bajur u slap haba la pyniatyngkhuh lang ia kine ki kynhun lyoh da ka bor ki lyer mih ka leilieh bad ka jingriew pyrthat.

U slap haba u hap u wallam biang ia ka jingsyaid kaba don ha u, kata kaba u la ioh na ki kjat Sngi bad kumta ha ka por slap ym ju khriat eh.

U slap haba u wan na ki syrtap ba kham hajrong ha suin bad haba u dei ban hiar lyngba ia ka syrtap lyer ba hapoh, kaba kham khriat u lang bad u sa hap ha ka dur u *phria (hail)*.

5. *Snow (thah ne ior)*. Haba ia ka water vapour ne ia u lyoh la rong shajrong eh sha ki syrtap lyer bakhriat eh ha

kiba ka temperature ka long kham hapoh ia ka freezing point (32° F.). te kata ka vapour ka kylla kum ki lyngkhot thah (ice-dust) kiba kham rit ban ia ki symboh ne drop slap bad ka sa hap ha khyndew kum ka jain sala. ia kane ki khot *snow*. Ha badei badei ka snow haba ka hap lyngba ia ki syrtap lyer bashit malu mala ka um katto katne bad ka hap ha sla khyndew kum ka um teiñ-teiñ kaba ki khot ka *Ior* ne ka *sleet*.

Ha ki ri kiba shit ka snow haba ka hap lyngba ia ki syrtap ba hapoh kiba kham shit ka kylla slap, hynrei ha ki ri khriat ka hap ha ki syrtap kiba ki khot *snow flakes*.

6. *Ice* (u *thah ba lang*). Haba ka temperature ka long ha ka freezing point, kata 32° F., ka um ka kylla eh bad ka lang, bad haba ka um ka kylla eh kumta, kata haba ka long ha ka solid state, ki khot *Ice* ne u thah ba lang. Kiei kiei haba ki lang ki rit, hynrei ka um haba ka lang ne ka kylla ice ka heh, kata ka mut, ka shim jaka kham bun. U *Ice* u kham sting ban ia ka um, u long  $\frac{9}{10}$  na ka jingkhia jong ka; namar kata u per halor um. Don bun ki *Iceberg* ne ki *Ice mountain* kiba per ha ka duriaw ha kiba ka temperature ka long hapoh ia ka 32° F.

Ia ka lynglun bah (vast body) u *Snow* ne u *Ice* kaba tuid ne syntuid suki ia ki sharing lum ne ia ki jaka riat ki khot *Avalanche*.

*Ki jingiaid tawiar ne jingbeh (movements) ki lyer*. Haba ka lyer ka beh ki khot ia ka *wind*. Ia ka wind ia pynlong ha kane ka rukom:—Ki kjat Sngi ki pynshit ia ka sla ka khyndew bad ka lyer kaba beh ha syndah jong ka ruh ka shit bad namar ba ka sting ka kiew sha jrong; haba kumta ki lyer kiba kham khriat (cooler air) na ki jaka ba marjan ki beh sha pyrshah kata ka jaka na kaba kita ki lyer shit ki la kiew.

Ia ki *wind* la ai kyrteng bun jaid kat kum ka jingstet ba ki beh shi kynta kynta. Ia ki lyer kiba ia id kumba 7 mile shi kynta ki khot *Light Breeze* ne *Er jem*; ia kiba ia id hapdeng 25 bad 40 mile shi kynta ki khot *Wind* ne *Strong Wind*, ia kiba ia id kumba 40 mile tam shi kynta ki

khot *Gale*, ia kiba iaid kumba 60 mile shi kynta ki khot *Storm* ne *Eriong*, ia kiba iaid kumba 80 mile shi kynta ki khot *Tempest* bad ia kiba iaid 90 mile bad palat shi kynta ki khot *Hurricane* ne *Eriong* *Erngit*.

Ia ki jaka ha kiba don ki lyer ba lam khriat la ong ba ki long ha ka *high pressure*, namar ba ka lyer ha ki ka kham khriat bad kham khia, bad kumta u Barometer u kiew. Ki jaka kiba shaphang shatei bad shaphang shathie ki Tropic ki long ha ka *high pressure*.

Ki jaka pat ha kiba ka lyer ka kham shit la ong ba ki long ha ka *low pressure*, namar ka lyer ba ha ki, ba jur ka jingshit kaba kjit ia ka, ka kham sting bad kumta u Barometer u hiar. Ki jaka ha ki Tropic, kata ha u Equator bad ha ki Desert Region, ki long ha ka *low pressure*.

Hynrei ki jaka ha ki Pole ki long ha ka *low pressure*, namar la ka lyer hangia ka khriat eh bad ka khia hynrei ka don tang khyndiat bad ruh namar ba ka jaka ha ki Pole ka rit than haba ia nujor bad ki jaka sha kiwei pat ki bynta ka Pyrthei.

Ka *phang* na kaba ki lyer ki kham beh barobor ka long na ki jaka ka *high pressure* sha ki jaka ka *low pressure*, kata na ki jaka kiba khriat sha ki jaka kiba shit ne kiba kham syaid.

*Kumno la pynlong ia ka jingiaid tawiar (movement) ki Lyer?* Ki lyer kiba ha ki jaka u Equator namar ba jur ka jingshit ki kiew kham shajrong bad ki kham saphriang bad ki beh ruh sha ki jaka shaphang ki Pole. Te ki lyer kiba kham khriat bad kiba kham rben na ki Temperate Zone bad ki Polar Region ki beh kylliang, ki da iaid napoh kitei ki lyer shit, sha ki jaka kiba sha u Equator ki da khyndiat artad ia kita ki lyer shit ba kham sting ba kin kiew kham shajrong. Kine ki lyer khriat ynda ki poi ha ki jaka hajan u Equator ki kylla shit, ki sa kiew shajrong bad ki sa beh biang sha ki jaka shajan ki Pole na kiba ki la mih nyngkong. Kitei ki lyer shit pat haba ki la poi ha ki jaka shajan ki Pole ki kylla khriat bad ki sa beh biang napoh sha ki jaka u Equator na kiba ki la mih nyngkong. Ha kane ka rukom ki ia iaid ne ia beh tawiar.

la ki lyer lah ban bynta ha kine ki saw bynta:—

I Ki lyer kiba beh khlem da pud (constant winds).

II Ki lyer kiba beh ha ki por ba thikna (periodical winds).

III Ki lyer ne ki eriong kiba beh tang teng teng (occasional winds and storms).

IV Ki lyer kiba beh tang ha la ki jaka jaka (local winds).

I *Ki lyer kiba beh barobor constant winds. Kine ki hap ha ki lai bynta:— 1. Trade winds. 2. Anti-trade winds. 3. Polar winds.*

1. *Trade winds*—Kine ki long ki lyer khriat kiba beh na shajan ki Pole sha ki jaka u Equator. Namar ba ki jaka ha u Equator ki shit than ki lyer kiba na ki ki kiew shajrong eh bad kumta ki lyer khriat na shaphang ki Pole ki beh napoh jong ki sha ki jaka u Equator; bad lada ka pyrthei kam rotate ha la u axis kine ki lyer khriat kin beh barobor na North bad na South, hynrei namar ba ka rotation ka jur eh ha ki jaka pdeng ka pyrthei, kumta ki lyer kiba na shaneng u Equator ki phai bad ki beh na shaphang shatei lam mihngi, la khot ia ki *North East Trade Winds*; bad ki lyer pat kiba na shathic u Equator ki phai bad ki beh na shaphang shathic lam mihngi bad la khot ia ki *South East Trade Winds*. La khot ia kine ki lyer da kata ka kyrteng namar haba ki beh sha kijuh ki thain barobor ki iarap ia ki nongpyniaid jhad ban pyniaid suk ia ki ihad khaii na ki phang ba ki beh ma ki. Ki Trade winds ki beh na u Latitude 35° N. sha u Latitude 5° N. ha ka Northern Hemisphere bad na u Latitude 35° S. sha u Latitude 5° S. ha ka Southern Hemisphere. Kine ki lyer khriat ynda ki poi ha ki jaka bashit ki kylla um ba lang (condensed) bad ynda ki ia kynduh bad ki jaka lum ha kiba ka lyer ka khriat ki sa pynhap slap

Ha ki jaka u Equator kata hapdeng 5° N. bad 5° S. kaba long ka pud ba ki kut ki N.E. bad S. E. Trade winds ym don lyer kiba beh jur, kita ki jaka baroh sawdong ki long kum u panpoh ha uba ki *lyer ba jai jai* ki beh (*belt of calms*) bad la khot ia kita ki jaka *Doldrums* (kaba mut

*dullness*). Ha kine ki jaka haba dei badei don ki lyer ki bashit than bad haba dei ba dei pat don u slap u bajur bad ki eriong kiba wan ryngkat bad ka jingkyrhuh pyrthat.

2. *Anti-trade winds*—Kine ki long ki lyer shit kiba beh na u Equator najrong ki Trade winds shaphang shatei bad shathie. Kine ki lyer ynda ki la poi ha ki jaka ha u Lat.  $35^{\circ}$  N. bad  $35^{\circ}$  S. namar ba ki ia khapngiah ba ka jaka shata ka kham rit bad ruh namar ba ki la kylla khriat ki hiar kham hapoh bad ki beh sha ki jaka ki Pole. Ha ka Northern Hemisphere ki phai bad ki beh na shaphang shathie lam sepngi, bad la khot ia ki *S. W. Anti-trade winds*, bad ha ka Southern Hemisphere ki beh na shaphang shatei lam sepngi bad la khot ia ki *N. W. Anti-trade winds*. Ki jaka ba ki beh kine ki lyer ki long hapdeng ki Lat.  $35^{\circ}$  N. bad  $60^{\circ}$  N. bad hapdeng ki Lat.  $35^{\circ}$  S. bad  $60^{\circ}$  S.

Ha ka Northern Hemisphere namar ba don bun ka khyndew kaba pynwit ia ki *S. W. Anti-trade winds* kim da beh ryntih, hynrei ha ka Southern Hemisphere namar ba don bun tang ka duriaw ki *N. W. Anti-trade winds* kiba hapdeng ki Lat.  $40^{\circ}$  S. bad  $50^{\circ}$  S. ki beh ryntih bad jur bha kumta la ai kyrteng ia ki *The Brave Winds*, bad namar ba ki beh naduh u Lat.  $40^{\circ}$  S. la khot ruh ia ki *The Roaring Forties*.

Haba ki jaka ba ki Trade winds bad ki Anti-trade winds ki ia kynduh ne ia pud, kata ha ki jaka ha ki Tropic of Cancer bad Capricorn ym don ki lyer kiba beh jur bad la khot ia ki *Belt of Calms*. Ba namar ba ki long ki jaka ha kiba ki lyer ki shit bad ki lyer khriat ki ia iaid lait kumta ki lyer kim lah kylla um kloï (condensed), dei namarkata ka daw ba don bun ki desert ha kine ki Belt, kum ka Sahara, Arabia, Persia, Thar, Kalahari, Australian Desert, etc.

Ia ka jaka ki lyer bajai jai lane ka belt of calm kaba ha North Atlantic la khot *Horse Latitudes* namar shisien ki jhad (ba la pyniaid da ki lama) haba ki kit ia ki kulai na New England (kaba ha East ka N. America) sha West Indies ki la dei ban bred noh ia ki kulai shapoh duriaw ba la duna ka um dih.

3 *Polar winds* Kine ki long ki lyer dait thah, ki bym don um, kiba beh bun bnai ha ka shisnem na ki Pole sha ki jaka ki Temperate Zone; na ka Arctic Ocean ki beh na North East bad na ka Antartic ki beh na South East.

II. *Ki Lyer kiha beh ha ki por ba thikna (periodical winds)*. Kine ki Lyer ki hap ha ki ar bynta:—1. *Land bad Sea breezes* bad 2. *Ki Monsoon*.

1. *Land bad Sea breezes*. Ka Khyndew ne ka Ryngekew ka kijit kloī mynsngi ia ka jingshit na ki kjat sngi bad ka pynmih ne ka prie ia ka ruh kham kloī mynmiet, kata ka mut ka shit kloī bad ki khriat ruh kloī Ka Um ne ka Duriaw ka kijit suki ia ka jingshiu bad ka pynmih ruh suki ia ka, kata ka mut ka shit suki bad ka khriat ruh suki. Te mynsngi haba ka khyndew ka shit ki lyer na ka ki kiew shajrong bad haba kumta ki lyer ba lam khriat bad ba kham khia na duriaw ki beh napoh sha ryngkew; ia kine ki lyer la khot *Sea breezes* bad ki sdang beh naduh shwa ban ieng ka sngi (forenoon) haduh ynda sepsngi. Mynmiet pat ki lyer ha ka sla ka khyndew ba ki la khriat ki kham khia, katba ki lyer ha ka sla duriaw ki kham sting ba ki khriat suki, te ki kiew shajrong, bad haba kumta ki lyer ba kham khia na ryngkew ki beh napoh sha duriaw; ia kine ki lyer la khot *Land breezes* bad ki beh naduh janmiet haduh ban da sep.

2. *Monsoons*. Ka ktien monsoon ka mut ka aiom. Kine ki lyer ki long hi ki Trade winds, hynrei la khot Monsoons ia ki namar ki beh tang ha ki aiom ba thikna bad ba ki kylla la ki phang na kiba ki beh ki da wallam slap artad. Kumba shiteng snem, kata haba long pyrem bad liur ha ka Northern Hemisphere ki Monsoon ki beh na ki duriaw kiba shaphang shatheī sha ki ryngkew kiba shaphang shatei, bad kumba shiteng snem pat, kata ha ki por synrai bad tlang lanc haba long pyrem bad tlang ha ka Southern Hemisphere ki beh na ki duriaw kiba shaphang shatei sha ki ryngkew bad ki duriaw ba shaphang shathie. Kumta ki Monsoon ki hap ha ki ar bynta:—(a) *The South West Monsoon* bad (b) *The North East Monsoon*.



(a) *The South West Monsoon ne Summer Monsoon.*  
 Haba ka long liur ha ka Northern Hemisphere ki jaka kiba ha u Tropic of Cancer, kata ha Southern Asia, Northern Africa bad Mexico, ki shit bha namar ka Sngi ka ieng beit ha ki. Ki lyer te kiba ha ki, ba ki shit, ki stang bad ki sapfred bad ki kiew shajrong, haba kumta ki lyer ba kham khriat bad ba kham khia na ki duriaw ba shaphang shathie, kiba long ki S.E. Trade winds, ki beh napoh shaphang shatei ban pyndap ia ki jaka kita ki lyer ba la kiew shajrong. Ha India bad Southern Asia kine ki lyer ki jur bha. Ka long kumne:—Ki S.E. Trade winds ki poi na shaphang shathie ha ki jaka u Equator bad namar ba ka bor ka rotation ka pyrthei na West sha East ka jur bha ha kita ki jaka kine ki lyer ki phai shaphang shatei lam mihngi, kata ki wan na shaphang shathie lam sepngi bad la khot ia ki *S. W. Monsoon*, ki da beh bun mile lyngba ka duriaw ki kit artad lem bad ki ia ki jinghaw um basngem bad ba syaid; te haba ki ia kynduh bad ki Lum ha kiba ka lyer ka khriat ki kylla um ba lang (condensed) bad ki sa hap ha ka dur u slap. Ki *S. W. Monsoon* kiba na ka Arabian Sea ki ia kynduh nyngkong bad ki Lum ha kiba ha ka Western Coast ka India, bad kumta u slap u jur ha kita ki thain. Ka syrtap kine ki lyer kaba hajrong ka beh shaphang shatei lam mihngi, kata lyngba ka Central India sha ka Gangetic Plain, bad namar ba la khang ia ki da ki Himalaya ki pynhap ia u slap ha ki jaka ba ha kjat jong ki; ka rotation ka Pyrthei ruh ka nang ring ia kine ki lyer wallam slap ban beh shaphang mihngi shaduh Assam. Ki *S. W. Monsoon* pat kiba na ka Bay of Bengal ki ai slap ia ka Western Coast ka Burma bad shi bynta na ki katba ki beh shaphang shatei lam mihngi ki ia kynduh ia ki *Monsoon* kiba na Arabian Sea ha ki jaka lum ka Assam kiba phai shaphang shathie, bad hangta ki pynhap shibun eh u slap lem bad ka jingkyrhuh pyrthat bajur bad ka leilieh. Ha Cherrapoonjee ha Khasi Hills, kaba ha khlieh ki pyntha kiba phai sha Bay of Bengal, u slap u jur tam ha ki jaka ka pyrthei baroh. Kine ki *Monsoon* na Arabian Sea bad Bay of Bengal ynda ki iasoh ki beh bad kit ia u slap nadien ka tduh ki Himalaya shaduh East

China bad Japan. Ka Sindh bad Punjab ki ioh slap tang nam namar ka rotation ka Pyrthei ka ring bad ka pynphai ia\*ka lyer wallam slap sha ki jaka ba shaphang mihngi ka India.

Ha Central America ruh don ki Monsoon tang namar bym bun ka ryngkew kim da jur slap eh.

(b) *The North East Monsoon ne Winter Monsoon.* Haba ka long liur ha ka Southern Hemisphere (kata haba ka long tlang sha ngi) ki jaka kiba ha u Tropic of Capricorn ki shit bha, ki lyer hangta ki sting bad ki kiew sha jrong kumta ki lyer ba kham khriat bad ba kham khia na shaphang shatei, kiba long ki N.E. Trade winds, ki beh napoh sha ki jaka u Equator la kine ki lyer la khot *N. E. Monsoon*, namar ba ki wan na shaphang shatei lam mihngi; bad namar ba ki la iaيد lyngba ia bun ka ryngkew, kata ia ka Central Asia, kim don bun um ha ki bad la ka rotation ka Pyrthei ka pynphai ia ki shaphang mihngi hynrei kim lah ban ai slap ia ka India namar ba la khang da ki Himalaya. La kumta ruh ka bynta kine ki lyer kaba iaيد lyngba ia ka Bay of Bengal ka ioh katto katne ki jinghaw um na ka bad ka pynhap slap ha ki rud duriaw ka Bengal bad rud duriaw ka Madras naduh u November haduh u February. Ka Madras ka ioh slap bun myntlang, kata na ki N.E. Monsoon, mynliur kam ioh slap na ki S.W. Monsoon kiba na Arabian Sea ba la kah ia ka da ki Western Ghats. Ka Ceylon bad ka North Eastern Coast ka India ka ioh slap na baroh ar ki Monsoon.

Ha Australia ruh ki N.E. Monsoon ki poi, hynrei namar bym don bun ka ryngkew kim da jur slap eh.

Kine ki Monsoon ne ki lyer wallam slap, khamtam ki S.W. Monsoon kiba iaيد lyngba ia ka bynta ba kham bun ka India namar ba la khang ia ki da ki Himalaya ki iarap ban pynlong ia ka ri kaba bit ban rep ban riang bha (agricultural country). Lada yn ym don Monsoon ka India kan long ka desert kumba long lem kiwei pat ki ri kiba ha ujuh u Latitude.

*III. Ki Eriang kiba beh tang teng teng (Occasional Winds bad Storms).*

Lah ban bynta ia kine ha ki 5 bynta—1, *Cyclone*. 2. *Anti-Cyclone* 3. *Tornadoes* ne *Hurricanes* ne *Typhoons* 4. *Waterspouts*. 5. *Sandspouts*.

*Cyclone* ne *Erlangthari*. Haba kano kano ka bynta ne ka lynnong ha ka sla ka pyrthei ka kham shit ban ia ki jaka ba marjan ki lyer kiba ha ka ba ki shit ki kiew shajrong (kata ka mut, kata ka jaka ka long ha ka low barometric pressure), bad ki lyer kiba kham khriat na kita ki jaka marjan ki tur sha kata ka jaka na ki dong baroh. kumta haba don ki lyer ha kata ka jaka kiba iatur kulmar shapoh bad kiba kiew artad shajrong, ka mih ha ka ka jingbeh ia kiew lyngwiar ki lyer kiba jur kiba ngi khot ki Erthari.

Haba kita ki lyer shit ki ia kynduh bad ki lyer khriat ki kylla um ba lang (condensed) nangta sa hap u slap. Ia ka lyer kaba beh jur lyngwiar, lem bad ka jinghap slap, tang ha ki bynta ne ha ki lynnong ha kiba ka jingkhia ka lyer ka shit, kata tang ha ki jaka kiba long ha ka low barometric pressure, ki khot *Cyclone*.

Ki *Cyclone* ki kham don ha ki jaka ba iaaid ki Monsoon kata ha ki jaka kiba harud ki duriaw kiba ha ki Tropics bad ki kham khie ruh ha ki bnai kiba sdang bad kiba kut ki Monsoon. Nalor ka jingbeh lyngwiar jong ki ia kita ki jaka ki iaaid ruh shaphang shatei bad shaphang shathie lam sepngi shaduh jan ki jaka ki Pole bad hangta ki sa kham duna bor. Ka jaka ha kaba ki iaaid ki *Cyclone* ka kham heh, bad ki beh jngai ruh bun phew mile.

*Ki phang sha kiba ki Cyclone ki beh:*—Ka *Cyclone* haba ka beh lyngwiar ha ki jaka kiba ha ka Southern Hemisphere ka iaaid kum ki kti ka baje, kata na *North sha East, sha South bad sha West bad hadien sha North pat*, haba ka beh ha ki jaka ha ka Northern Hemisphere ka iaaid markhongpong ia kaba iaaid ki kti ka baje, kata na *North sha West, sha South, sha East bad hadien sa sha North pat*.

*Ki mih shibun ki jingpynjot na ka Cyclone.* Ia ki ing ka rong, ia ki diengbah ka rat, ia ki lieng bad ki jhad ka kynting bad pynngam, ki jingatphyllung ki khie jur bad ki kiew shaduh shajrong bad bun ki briew ruh ki iap bad ki mynsaw.

2. *Anti-Cyclone.* Ha ka lynnong kaba hapdeng ar tylli ki jaka ba ki khie ki cyclone ka lyer ka kham rben bad kham khia namar ka long kumba la khnoit ia ka hapdeng (kata ka mut, ba kata ka lynnong ka long ha ka high barometric pressure), haba kumta ka jinglong ka lyer ha kata ka lynnong ka iapyrshah ia ka jinglong kaba ha ki jaka ha kiba don ki cyclone (kata, kiba long ha ka low barometric pressure) bad na kata ka lynnong ba napdeng ki lyer ki bym da jur than eh ki khie bad ki beh lyngwiar kham na tbian: la khot ia ki *Anti-Cyclone*. Ki Anti-cyclone haba ki beh ha ki jaka ha ka Northern Hemisphere ki iaid kum ki kti ka baje, kata na *North sha East, sha South, sha West bad hadien sha North pat*, hynrei haba ki beh ha ki jaka ha ka Southern Hemisphere ki iaid markhongpong ia kaba iaid ki kti ka baje, kata na *North sha West, sha South sha East bad hadien sha North pat*

*Balei ba ka Cyclone haba ka beh ka wallam slap artad, katba ka Anti-cyclone pat ka beh khlem slap?*

Ki lyer shit ha ki jaka ba ka cyclone ka beh ki kiew shajrong, te ka water vapour kaba ha ki haba ka iashem bad ki lyer khriat ka kylla um ba lang (condensed) bad sa hap slap. Hynrei ki Anti-cyclone kim don slap namar ki lyer ha ki jaka ba ki khie ki hiar kham sha tbian bad kumta kim lah kylla um ba lang (condensed).

3. *Tornadoes ne ki Erthari ha kham jur.* Kine ki long ki storm ne ki lyer cyclone kiba kham khlain, tang ba ki jaka ne area ha kiba ki beh ki kham rit bad ki iaid jngai ruh tang kumba 20 ne 30 mile. Ka jingpynjot ki Tornadoes ka kham khraw bad kham shyrkhei ban ia ka jong ki Cyclone. Ki *Tornadoes* ki kham khie ha United States. Kiba kum kita ki Erthari ki beh ruh ha West Indies, hangta la khot ia ki *Hurricanes*, bad ruh ha China bad Japan ha kaba la khot ia ki *Typhoons*.

Ki Cyclones, Hurricances, Tornadoes, Typhoons bad ki Whirlwinds ne ki Erthari ki hap hapoh ka kyrteng *Stroms*, bad la khot *Rotary Storms* namar ba ki beh lyngwiar ne ki iaid pyllun sawdong, kata ruh tang teng teng.

4. *Waterspouts.*—Haba ki Eriong Erngit ki beh ha duriaw, bunsien u lyoh uba kum ka shar uba kita ki lyer

ki pynshad ha la ka lyngwiar u ju hiar ha sla duriaw, u ring ruh ia ki um bad u pyniasoh ia ki bad ki lyoh kiba ha suih; kumta ki long bad ki ieng kum ki tyndong um ba jrong kiba ki khot *Waterspouts*.

5. *Sandspouts* -- Haba ki Eriong Erngit ki beh ha ki ri shyiap bunsien u lyoh uba kum ka shar uba kita ki lyer ki pynshad ha la ka lyngwiar u ju hiar ha sla khyndew, u ring ruh ia u shyian bad u pyniasoh bad ki lyoh ha suin; kumta ki long bad ki ieng kum ki tyndong shyiap bajrong kiba ki khot *Sandspouts*. Kine ki kham don ha Africa bad Arabia bad ki long kiba ma bad kiba shyirkhei shibun.

IV. *Ki Lyer kiba beh tang ha la ki jaka jaka (Local Winds)*. Kine ki hap ha ki ar bynta:— 1. *Ki Lyer shit* bad 2. *Ki Lyer khriat*.

1. *Ki Ershit*:—

(a) Ia ka Erkhuid ba pyniap op kaba beh ha ki ri shyiap Arabia bad Sahara ki khot *Simoom*.

(b) Ia ka Ershit kaba beh shaphang shatei na Africa ki khot ha Egypt bad N. E. Africa *Khamsin*, ha N. W. Africa *Harmattan*. Kane ka ershit ka iaid lyngba ia ka Mediterranean bad haba ka poi ha Sicily ki khot *Sirocco*, ha Italy *Bamiel*, ha Spain *Solano* bad ha ki Alps *Fohn*.

2. *Ki Erkhriat*:—

(a) *Mistral*.—Ka Erkhriat kaba beh jur ha S. E. France na ki Alps.

(b) *Bora*.—Ka Erkhriat kaba beh jur ha North Adriatic na ki Alps.

(c) *Blizzard*.—ka Erthah kaba wallam ior; kane ka beh ha ki jaka ba shaphang sepngi ka United State.

(d) *Pampero*.—Ka Erkhriat kaba beh jur ha ki Pampas ha South America.

(e) *Puna*.—Ka Erkhriat kaba beh ha ka Tableland ka Peru.

*U Slap*.—U Slap u ju hap shibun ha kiba kum kine ki jaka:—

1. *Ha ki jaka kiba ki lyer ki beh barobor*.—Ki lyer kiba shit haba la kijit ne ring ia ki shajrong ki iakynduh

bad ki lyer khriat bad ki sa kylla um (condensed), nangta ki sa hap ha ka dur u slap. Ki Anti-trade Winds kiba beh na ki jaka u Equator ba ki long ki bashit ki leit lam slap sha ki jaka kiba shaphang shatei bad shathie kiba ha ki Temperate Zone ynda ki la ia kynduh bad ki lyer khriat; katba ki Trade Winds pat kiba beh na ki jaka ba lam khriat ynda ki poi ha ki jaka shit kim da bun eh ka um ha ki bad kumta tang khyndiat u slap u hap na ki ha ki Ocean.

2. *Ha ka jingdon ki khyndew ba kham jrong, khamtam ki Mountains.* Ki lyer shit haba ki ia kynduh bad ki lum ha kiba ka lyer ka khriat ki kylla um (condensed) bad ki sa pynhap slap. Ki S. W. Monsoon ki pynhap slap shibun ha ki West Ghats, Himalayas, Khasi Hills, bad Western Burma, bad kumjuh ki S. W. Winds na North Atlantic ki pynhap slap ha ki lum kiba ha ki rud duriaw phang sepngi ka Ireland, Scotland, bad Norway.

3. *Ha ka jingdon ki lawbah ki baheh hun mile.* Ha ki jaka khlaw ka khyndew ka jur bha ka jingsngem bad kumta ka ring ia ki lyoh ha kiba don water vapour, nangta sa hap bun u slap, kum ha ka Amazon Valley bad ha ki Sunderbans ha ka rud duriaw ka Bengal.

*Ka rukom thew ia u slap* Ia u slap lah ban thew da ka tiar ba ki khot *Rain gauge* kaba long ka shar bilor ne shar tin kaba jrong kumba 8 inshi u diameter. Ia kane ka shar, la thep hapoh kawei pat ka kynja bilor ne tin pylun kaba kham heh. Baroh 24 kynta ki buh ha khyndew ia kata ka tin ne bilor pyllun bad ki jingjaw slap ki hap lyngba kata ka shar; nangta ki shim ia kata ka um ba la don bad ki thew ha kawei pat ka jingthew bilor ha kaba la buh dak shi inshi inshi (kum ka glass thew dawai) bad sa tip katta inshi u slap u hap shi sngi shi sngi.

Ia kita ki inshi kiba mih shi sngi shi sngi la khein lang bad ynda kut ka snem sa tip katta inshi u slap u hap ha kano kano ka jaka. Haba ong ba kano kano ka jaka *ka ioh slap katta inshi shi snem* ka mut ba lada ka um hangta kan ym tuid ne ngam shapoh khyndew hynrei kan shu iai lang hajuh te kan tap ia kata ka jaka haduh ka jingjrong ka inshi ba ka ioh slap.

Ha Mahabaleshwar ka shnong kaba ha ki Western Ghats. kaba jrong 4500 ft. na ka sea-level u slap u hap kumba 250 inshi shi snem. Ha Cherrapunjee kaba jrong 4200 ft na ka sea-level u slap u hap kumba 400 ne 500 inshi shi snem.

Ha ki jaka kiba hapteng ki Tropics kiba ha ka Old World u slap u hap man ka snem kumba 77 inshi average bad ha kiba ha ka New World pat kumba 115 inshi average.

*Climate.* Ka *Climate* ka mut ka jinglong ka ri ne ka jaka ha ka jingshit jingkhriat, ha ka jingioh slap, ha ka jingrkhiang jingsngem, ha ka jinglong ki lyer kiba beh ha ka bad ha kino kino ki jinglong ba kham pher ha ka atmosphere (phenomena of the atmosphere).

Ka Climate jong kano kano ka ri ka shong:—

1. *Ha ka Latitude*, kata ha ka jingjan ne jingjngai na u Equator : ki jaka kiba ha u bad kiba hajan ia u ki shit namar ba ki kjat sngi ki hap beit, bad ki jaka kiba jngai na u ki khriat namar ha ki ki kjat sngi ki hap sharing.

2. *Ha ka Elevation ne ka Jingjrong na ka sea-level.*  
Katba nangkiew sha ki ri lum kiba kham jrong ka nang kham khriat namar ki lyer hangta ki kham stang bad ka water vapour ha ki ruh ka kham duna ban ia ha ki jaka madan, kumta ka jingpynmih ia ka jingshit na ka sla ka khyndew (radiation) ruh ka duna ha ki. Hynrei ha ki jaka lum kiba ha ka line u Equator kam khriat ei ei. Ha Quito kaba jrong 9090 ft. na ka sea-level namar ba ka don ha U Equator kam khriat hynrei ka jaka ka pyngngad baroh shisnem.

3. *Ha ka Jingjan ne Jingjngai ka jaka na ka duriaw.*  
Ka khyndew ka kham shit kloï bad kham khriat kloï ban ia ka um, ka um pat ka kham shit suki bad khriat ruh suki; te ka duriaw ka kham syaid myntlang ban ia ka ryngkew bad kam kham shit eh ruh mynliur; haba kumta ki jaka hajan ki duriaw kim da khriat ne shit eh ba ki beh ki Erduriaw.

4. *Ha ki Lyer kiba beh barobor.* Ki lyer kiba beh na ki jaka bashit, kum ki S. W. Monsoon bad ki S. W. Winds na North Atlantic ki pynsyaid ia ki jaka sha kiba ki

poi; ki lyer khriat pat na ki Pole ki pynkhriat ia ki jaka sha kiba ki beh.

5. *Ha ka Bor bad ka Phang sha kaba ki tuid ki Current ki Ocean.* Ka N. W. Europe ka ioh jingsyaid na ka Gulf Sream, ka Japan na ka Kuro Siwa, hynrei ka Western Coast ka United States ka khriat ba ka tuid narud jong ka ka Labrador Current ka bakhriat.

6. *Ha ka jingieng ter (direction) ki lum bah.* Ki lum ki khang ia u slap ba kumta u hap tang ha ka liang na kaba ki beh ki er wallam slap katba sha ka liang sha lyndet jong ki ym don slap bun. Ki lum ki khang ruh ia ka lynti ki ershit ba kin ym poi sha ki jaka sha lyndet jong ki bad kumjuh ia ki erkhriat ruh ba kin sah tang sha ka liang na kaba ki beh.

7. *Ha ka Jingsharing ki jaka.* Ki jaka kiba phai beit sha ki kjat sngi, kum ki sharing lum, ki shit bha, katba ki jaka kiba phai kynriang na ki kjat sngi ki kham khriat. Nalor kata ka *jingsharing* ne ka *slope* ka ri ka long kat kum ka lynti ki river namar ka river ka tuid na ki jaka ba kham at sha kiba kham them. Ha ka Northern Hemisphere ne ka Land Hemisphere ha kaba don kham bun ka ryngkew ban ia ka um ka khyndew (haba khmih na ka lynti ki river) ka kham sharing sha South bad kita ki thain ki kham syaid ban ia kiba sha North.

8. *Ha ka Jinglong ki jaka na ka rep ka riang.* Ki jaka khlaw ki kham sngem hynrei ynda la pynkhuid ia ki khnang ban rep ban riang ki jaka ki kham rkhiang bad kham khriat.

Na kitei ki jingshisha ngi sngewthuh ba ka Latitude kam long ka pud bajanai na kaba yn rai ia ka climate ka jaka.

Ia ka Jingstad (science) kaba hikai ban tip bad ithuh ia ka jingkylla ka suin bad ka climate kano kano ka jaka ki khot *Meteorology*.

Ha ki bun ki jaka ka pyrthei ki don ki tiar (instruments) da kiba ki thew ban tip ia ka *meteorological condition* kano kano ka jaka.

Ki tiar ba ki kham pyndonkam ki long:—



1. *Thermometer* uba ki thew ia ka jingshit jingkhriat (temperature) ka atmosphere.

2. *Barometer* uba ki thew ia ka jingkhia jingsting ki lyer (atmospheric pressure).

3. *Rain gauge* uba ki thew ia ka jinghap u slap.

4. *Hygrometer* uba ki thew ia ka jingsngem ne jing-rkhiang (moisture) ka atmosphere.

Ki *Isotherms* ki long ki line ba la ring ha ki Map ban pyni ia ki jaka kiba ia long katjuh ka *jingshit jingkhriat* ne ka *temperature* ha ka por liur bad ruh ia ki jaka pat kiba ia long katjuh ka *temperature* ha ka por tlang.

Na kine ki line lah ban iohi ba don ki jaka kiba iadei katjuh ka *temperature* ha ka por mynliur hynrei kim iadei pat katjuh myntlang.

Ka *mean temperature* jong kano kano ka jaka ka mut ka jingpynmariabing (average) shi sngi shi sngi ia ka *temperature* kaba la ioh da kaba khein lang ia ki degree ka jingkiew jinghiar u *Thermometer* man ka sngi ha ka shi snem ha kata ka jaka.

Ki *Isobars* ki long ki line kaba la ring ha ki Map ban pyni ia ki jaka kiba ia long katjuh ka *jingkhia jingsting* ne ka *barometric lane atmospheric pressure* ha la ki aiom.

*Balei ba kham khriat mynmiet ban ia mynsngi?* Mynmiet nalor ba ka khyndew kam ioh jingshit na ki kjat sngi hynrei ka khlei pat (radiate) ia ka jingshit ba ka la ioh mynsngi na ka Sngi; kumta ki miet ki kham khriat.

*Balei ba ki miet ba don lyoh ki kham syaid ban ia ki miet bym don lyoh?* Ki lyoh ki long ka water vapour ba don um katto katne (partially condensed). Haba ki don mynmiet ha suin haneng khyndew ki kah ia ka jingshit kaba mih (radiation) na ka sla khyndew bad kumta haba bun lyoh ki jaka ki kham syaid. Hynrei ha ki miet bym don lyoh ka jingshit kaba mih na ka sla ka khyndew ka kham iaid saphriang sha suin bym don ba kah ia ka, namar kata ha kum kita ki miet ka kham khriat.

*Balei ba ki miet ki kham khriat ha ki ri shyiap (desert) kiba shit?* Ha ki ri shyiap ba shit ka lyer ba ha suin haneng khyndew ka don tang khyndiat, kumta ka water va-

pour ba ha ka kam lah khang ei ei ia ka jingshit kaba mih mynmiet (radiation) na ka sla ka khynew ba kan iaiaid saphriang sha suin; namar kata ki miet ha kita ki jaka ki kham khriat.

*Balei ka kham shit mynsngi ban ia mynstep bad janmiet?* Mynsngi ki kjat sngi ki ieng beit bad ki sam lyngba ia ka syrtap lyer ka bym da rben eh, kumta ka kham shit; hynrei mynstep bad janmiet ki kjat sngi ki ieng sharing bad ki sam lyngba ia ka syrtap lyer kaba kham rben, kumta ki kham khriat.

*Balei ka kham syaid mynliur ban ia myntlang?* Mynliur ka sngi ka ieng beit haneng ki khlieh jong ngi ban ia myntlang bad ki kjat sngi ruh ki sam lyngba ia ka syrtap lyer ka bym da rben eh, kumta ki kham hap beit bad kham jur bor ha ki bun ki jaka ka pyrthei; nalar kata ba ki sngi ki jrong mynliur ka sla ka pyrthei ka ioh jingshit kham slem na ka Sngi. Myntlang pat ki kjat sngi ki shat sharing bad ki sam lyngba ia ka syrtap lyer kaba kham rben, kumta kim da jur bor eh bad ki hap ruh tang ha ki katto katne ki jaka, nalar kata ba ki sngi ki lyngkot ka sla ka pyrthei ka ioh jingshit tang khyndiat por

*Ka Jingbynta ia ki Jaka ka Pyrthei kat kum ka Jingdon ki Dieng ki Siej bad kiwei kiwei ki Jingthung (Flora).*

Lah ban bynta ia kane ha kine ki bynta:—

1. *The Equitorial Forest Belt.* Ki dieng bad ki kynja jingthung ki donkam ia ka jingshit bad jingsngem, kumta ha kane ka Belt ba shit don bun ki lawbah lawsan ha kiba don ki diengbah, kum ki lawbah ha Amazon Valley kiba ki khot ki *Selvas*, bad ki lawbah ha ki jaka ki river Congo bad Zambesi. Ki dieng kiba kham don dor ha kine ki jaka ki long mahagony bad ebony; ki diengtlai bad ki kait ki mih bun ha ki rud duriaw. U phlang um mih bun hapoh ki jaka khlaw namar um ioh bha ia ka jingshai bad ka jingshit.

2. *North bad South Tropical Belts.* Ha kine ki belt don ar ki bynta ba kongsan:—(a) *Grasslands*, kata ki jaka ha kiba ki khlaw ki kham rit bad ha kiba bun ki jaka phlang. U kba, u kew ruh ki mih ha kine ki jaka lada haba slap kham bun. (b) *Monsoon lands*, kata ha India, China, Japan

bad S. E. Asia. Kine ki jaka ba ki ioh slap bun ki long kiba seisoh tam bad kiba bun briew tam ha ka pyrthei. U kba, kew, sha, coffee, phan bad kiwei kiwei ki jaid jing-bam ki mih bha ha kine ki jaka

3. *North bad South Sub-tropical Belt lane ki Tropical Deserts.* Ka khyndew ha kine ki jaka ka ryngkhiang bad tyrkhong bha namar ba ka shit than bad kumta ki long ki bym seisoh,

4. *North bad South Warm Temperate Belts.* Ki jaka ha kine ki belt ki lam shit ba ki jan ia ki Tropical Deserts, Ki dieng ha ki kim long bha, hynrei ha ka por pyrem bad liur don ki jaka phlang kiba bha bad ki jingri, kum ki masi, ki langbrot etc., ki im bha, kum ha ki *Steppes* ha S. E. Europe, ki *Prairies* ha N. America bad ki *Pampas* ha S. America.

5. *North bad South Cool Temperate Belts.* Kine ki jaka ki lam khriat; don ha ki bun ki khlaw ha kiba ki sla kiba na ki dieng ba ha ki ki hap shipor (deciduous), kum ki oak, ash, elm, beech, birch larch, bad maple.

6. *The Pine Forest Belts.* Kine ki jaka ki don haneng ka N. Temperate Belt bad don ha ki bun ki dieng kiha ki soh jong ki ki long shyieng ne symbai ba eh (coniferous), kum ki pine (kseh) fir (kseh bilat) etc. Na ki pine ki shna lyntang, synduk bad ki dieng jingpruid, na ka um jong ki ki shna ia ki kynja tyrphin bad ki rong.

7. *The Arctic Belt.* Ki jaka harud ka Arctic Ocean ki long kiba madan bad lam sharing kiba tap bun bnai da u thah, kiba ki khot ki *Tundras*. Ki dieng kiba lyngkot bad ki kynja niut maw ki mih pateng pateng ha ki.

8. *North bad South Polar Snow Deserts.* Kine ki jaka ki long kiba la tap tang da u thah suda bad ki long ki bym seisoh.

9, *The Mountain Belts.* Ki jaka ba ha kjat ki Mountain ki long kat knm ka jinglong ka jaka ha kaba ki don. Ha ki jaka pdeng lum namar ba ki shu syaid ki jingthung ki long kum kito kiba don ha ki Warm Temperate Belt, bad ha ki jaka khlieh lum ba ki kham khriat ki jingthung ki long kum kito kiba don ha ki Cool Temperate Belt.

*Ka Jingbynta ia ki Jaka ka Pyrthei kat kum ka jingdon ki Mrad ki Mreng (Fauna).*

1. *Ha ka Equitorial Belt*—ki sing, khla, rhinoceros, crocodile, ut, giraffe, bun jaid ki sim bad ki skain.

2. *Ha ki Tropical Belts*—(a) *Ha ki Grasslands*—ki hati, rhinoceros, giraffe, antelope, savannas, (b) *Ha ki Monsoon lands*—ki hati, suri, etc.

Ki Mrad ha ki Equitorial bad Tropical Belt ki kham heh, bad kham khlain ba ki ioh kyrhai ka jingbam bad ka um.

3. *Ha ki Tropical Deserts*—ka ut ka long “ka jhad ka ri shyiap” ha Sahara bad Arabia.

4. *Ha ki Temperate Belts*—ki suri, dngiem, weasel, etc. Ki jingri kiba don ha kine ki belt, kum ki masi, langbrot etc, ki sngaid bha bad ki bha met.

5. *Ha ki Arctic bad Polar Belts*—ki reindeer, seal, whale etc.

Hynrei bun ki sim bad ki dohkha bad katto katne jaid ki mrad kiba don ha ki bynta ka pyrthei baroh.

*Ka Jingbynta ia ki jaka shong ki Briew (Mankind) ha ka Pyrthei.*

Kane ka shong ;—

I. *Ha ka jingjan ne jingjngai ki jaka na u Equator.*

II. *Ha ka climate ne ka jinglong ki jaka ha ka jingshit jingkhriat.*

III. *Ha u slap bad ka jingsbur ki jaka.*

IV. *Ha ka jingdon ki Lum bad ki Plateau (relief of the land).*

I. *Ka jingjan ne jingjngai ki jaka na u Equator.* Ha ki jaka ba kham jan ia u Equator bad ha ki Temperate Zone ba ki syaid bad kham seisoh ki briew ki ia shong bun ban iarep iariang: shajan ki Pole ba ki khriat bad ba kim seisoh ki briew ki shong tang khyndiat eh, kum ki *Lapps* bad ki *Samoyedes* kiba shong ha ka Tundras Belt bad ki *Eskimos* kiba shong ha Greenland bad ha ki Island ka Arctic Ocean.

II. bad III. *Ha ki jaka ha kiba ka jinglong ka bneng kam da shit ne khriat eh bad ha kiba u slap u kham hap* ki briew ki iashong bun ban iarep iariang, kum ha Central bad

Western Europe, ha America bad khamtam eh ha India. Burma, S.E. Asia, China, Japan, namar ba ka khyndew ha ki ka sbur bha ba ki ioh slap kyrhai.

IV. *Ha ki jaka Lum bad ki Plateau* ki briew kim da ia shong bun eh ba myntlang ki jaka ki khriat bad mynliur pat ki shit, artad ruh ba ka khyndew kam long kaba seisoh namar ka *soil* ha ki kam da jylliew. Ha Tibet bad ha ki Andes ki briew ki ia khyndiat shibun haba ia nujor bad ka jingheh kita ki jaka.

Don ki jaka ha kiba mynhyndai ki ia shong bun phew hajar ki briew hynrei mynta don sa tang khyndiat eh, kum ka Nile Valley ha Egypt bad ki jaka harud ka Euphrates bad Tigris ha kiba ki shong ki *Assyria* hyndai. Ka daw ka long ba ia kita ki jaka la tap suki pa suki da u shyiap bad ki kylla bym seisoh.

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Ia ka jingstad (science) kaba hikai ban tip shaphang ka jingheh, ka jingiadei, ka jingiaid etc. ki Met bneng (stars) ki khot *Astronomy*.

Ia ka jingstad kaba hikai ban tip shaphang kiei kiei ki-ba don hapoh ka sla ka khyndew, kum ki rock bad kiwei kiwei ki mineral ki khot *Geology*.

Ia ka jingstad kaba hikai ban tip shaphang ka dur, ka rukom san etc. ki jingthung, kum ki dieng ki siej, ki syntiew ki skud kiba mih ha ka sla ka khyndew ki khot *Botany*.

Ia ka jingstad kaba hikai ban tip shaphang ka dur, ka rukom im etc. ki mrad kiba don ha ka pyrthei ki khot *Zoology*.

Ia ka jingstad kaba hikai ban tip shaphang ka jingmih, ka jingsan bad ka jingim ki mrad bad ki jingthung ki khot *Biology*.

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KUMNO BA PYNLONG IA KA JINGBAM HYN-ROH U BNAI:—Katba ka Pyrthei bad u Bnai ki shad sawdong ha la ka *lynti suin* ne ka *orbit* don ka por ha kaba ka Pyrthei ka don hamar pdeng ka Sngi bad u Bnai haba u pyllun, kata ki ia long baroh lai tylli ha ujuh u line—ka Sngi, ka Pyrthei, u Bnai. Bad ka Pyrthei ba ka don

hapteng ki kjat sngi ba phyrnai ka shat la ka syrngiew ha u Bnai bad ka kah ruh ia u. Dei namar kata ka daw ba ngi iohi ha ki miet ba bam hynroh u Bnai ba ka jingshai jong u ka kham jngud ban ia kaba u ju long. Ka jingbam hynroh u Bnai ka long syriem kumba lada buh lane pyn-ieng ia kaei kaei hajan ka sharak mynmiet kata kaei kaei kan shat la ka syrngiew ha ka kynroh.

Ka *lynti suin* u Bnai kam ju iaaid beit barobor, ka kham khun. Dei tang ha ki por haba u don beit hapteng ka Sngi bad ka Pyrthei ba jia ki Jingbam hynroh ha u (*eclipse of the moon*), namar lada ka *lynti suin* jong u ka iaaid beit khlem khun yn bam hynroh man u bnai ha ki miet ba u Bnai u pyllun.

Hynrei don ki por ha kiba u Bnai u iaaid tang khyn-diat shaphang ki jaka ban ia long ha ujuh u line bad ka Pyrthei bad ka Sngi: ha kiba kum kita ki por ka ju jia ka jingbam hynroh tang malu mala ha u kaba ki khot *partial eclipse*.

KUMNO BA PYNLONG IA KA JINGBAM HYNROH KA SNGI:—Katba ka Pyrthei bad u Bnai ki shad sawdong ha la ka *lynti suin* don ka por ha kaba u Bnai u don hamar pdeng ka Sngi bad ka Pyrthei, kata ki ia long ha ujuh u line,—ka Sngi, u Bnai, ka Pyrthei. Haba ka long kumta u Bnai u kah ia ki kjat sngi ba kin ym shat sha ka Pyrthei, kata ka mut ba ka syrngiew jong u ka shat ha ka Pyrthei. Te haba u Bnai u kah ia ki kjat sngi (la ngim iohi ia u mynsngi) ka mih ka Jingbam hynroh ka Sngi ne ka *eclipse of the sun*. Ha kiba kum kita ki por ngi iohi ia ki kjat sngi ba ki kham dum.

U Bnai namar ba u kham rit, ka syrngiew jong u kam lah shat ha kajuh ka por sha ki jaka ka Pyrthei baroh kawei, kata ka mut ba ka jingbam hynroh ka Sngi ka paw tang ha kita ki bynta ka Pyrthei ha kiba u Bnai u kah ne u shat la ka syrngiew.

Haba ka jingbam hynroh ka Sngi ka jia ha ka por ba u Bnai (haba u iaaid ha la ka *lynti suin*) u kham jan ia ka Pyrthei te u lah ban kah shi por ia ki kjat sngi haduh ba i kumba kan dum.

Don ki por ha kiba u Bnai u iaid ne u kah tang khyn-diat shaphang ki jaka hapteng ka Sngi bad ka Pyrthei. Ha kiba kum kita ki por ka ju jia ka jingbam hynroh ka Sngi tang malu mala (*partial eclipse*).

Don pat ki por ha kiba ngi iohi ba u Bnai i kumba u la kah lut ia ka Sngi. Hynrei ha ka jingshisha namar ba u rit um lah kah lut, kumta ki kjat sngi la kim lah shat na ka pdeng jong ka Sngi hynrei ki shat tang na ki rud jong ka. la kaba kum kata ka jingkah ne ka jingbam hynroh ki khot *annular eclipse*.

Kaba ngi ki Khasi ngi ong ba ka hynroh ka pyllait suki pa suki ia u Bnai ne ia ka Sngi ka long namar ba ka Pyrthei bad u Bnai katba ki shad sawdong ha la ka *lynti suin* ki ia iaid lait suki kawei ia kawei bad kumta kata ka jingkah ruh ka lait ynda hadien katto katne minit namar ba u Bnai ba u kham rit u shad sawdong kham stet ban ia ka Pyrthei.

